C

ICAR.12.59
1340.

सत्यमेव जयते

ANNUAL REPORT

OF THE

INDIAN COUNCIL OF AGRICULTURAL RESEARCH

FOR 1958-59.

RAM

COMMONWEALTH MYCOLOGICAL INSTITUTE
8 JAN 1962

PRINTED IN INDIA BY THE MANAGER GOVT OF INDIA PRESS NASIK ROAD AND PUBLISHED BY THE MANAGER OF PUBLICATIONS DELHI-8
1961

Price · Rs. 7·75 nP.

ANNUAL REPORT

OF THE

INDIAN COUNCIL OF AGRICULTURAL RESEARCH

FOR

1958—59

CONTENTS

SUMMARY i

CHAPTER I—ADMINISTRATION

Official changes 1
Allotment of funds 1
Finance and Accounts 1
Meetings 2

CHAPTER II—AGRICULTURAL RESEARCH

Botany (Physiology) 3
Entomology 16
Agronomy and Soil Science 21
Tuber Crops 24
Vegetables 26
Fruits 30
Spices and Miscellaneous Crops 38
Agricultural Implements 40
Millets 41
Maize 41
Lac 43
Coconut 43
Arecanut 44
Tobacco 44
Oilseeds 48
Jute 50
Cotton 51

CHAPTER III—ANIMAL HUSBANDRY RESEARCH

Cattle Breeding 52
Sheep Breeding 59
Goat Breeding 63
Poultry Breeding 64
Disease control 66
Dairying 74
Animal Nutrition 78
Hides and Skins 88

PAGE

Pisciculture 89

Apiculture 90

CHAPTER IV—STATISTICAL RESEARCH

Advisory work 91

Training 91

Research 98

Statistical Analysis 99

Surveys 104

Agricultural Economics 105

CHAPTER V—AGRICULTURAL AND VETERINARY EDUCATION

Short course in Veterinary Science. 108

Post-graduate Education 108

Agricultural University in Uttar Pradesh 109

Inter-institutional arrangements 109

Agricultural Education 109

Second Joint Indo-American Team 111

CHAPTER VI—PUBLICATIONS AND PUBLICITY

Publications 112

Journals. 112

Farm Bulletins 112

Leaflets and pamphlets 113

Books 113

Animal Health Information Service 114

CHAPTER VII—LIBRARY

Acquisition Section 115

Statistics 117

APPENDICES 119

SUMMARY

The Indian Council of Agricultural Research during 1958-59 continued to sponsor and initiate research in agriculture, animal husbandry, agricultural and veterinary education and statistics. The activities during the previous year are summarised below.

Research

Agriculture

Research schemes sponsored by the Council in agriculture, horticulture and related subjects made all round progress. Results of some important schemes are given below :

A co-ordinated scheme to study the effects of nutrients on seeds of cotton, wheat and maize was undertaken at Indore, Indian Agricultural Research Institute, New Delhi, and Uttar Pradesh. Plant introduction and physiological studies continued at Vivekananda Laboratory at Almora.

Effect of synthetic hormones was studied on a few crops in Bombay. At Delhi University, studies on pollen grains and pollen tubes of *Cajanus* and on chemical stimulation of ovule were undertaken.

Rice breeding schemes initiated by the Council included a study for raising synthetic and flood resistant varieties and disease-free strains, investigating the cause of blast resistant and drought resistant varieties, and a study on improved strains of paddy under lift irrigation. The stem rot disease of rice was investigated at Madras. Application of insecticides for controlling the rice stem borer gave encouraging results in West Bengal, Andhra Pradesh and Madras.

Coordinated wheat rust control schemes continued to operate at the Centre and in the States. At the Indian Agricultural Research, Institute, New Delhi, resistant to black rust of a number of varieties was tested. In Madhya Pradesh, crosses were attempted in *durum*, and *vulgare* varieties to produce rust resistant progenies. At Indore, or recommended for use.

Selection of barley and other millets was in progress in different States. Attempts to raise better strains of *bajra* by selection continued in Bombay, side by side with the activities to study the diseases, multiplication and distribution of hybrid *bajra*. Evolution of *Sorghum* (*jowar*) resistant to striga parasites by selection and hybridization was undertaken in Andhra Pradesh.

Various schemes for improvement of pulses continued in different States.

The Central Grassland Survey Scheme operated in Jodhpur. A study of cytogenetics of wild grasses and experiments for breeding them for selective fodder and forage grasses were undertaken at Coimbatore. An inter-specific hybrid between *Chloris ciliaris* and *C. glaticus* was found to be successful and fertile. Schemes on improvement of fodder grasses, pasture grasses, all legumes continued in the various States. Termite research schemes were in operation at the Forest Research Institute, Dehra Dun and the Indian Agricultural Research Institute, New Delhi. Studies on the effects of synthetic pesticides on stored grains, field crops, etc., were continued at the Indian Agricultural Research Institute, New Delhi, and the Agricultural College and Research Institute, Coimbatore. At the Indian Agricultural Research Institute, nutritional and biological studies on insects were also undertaken. A study on the physiological relationship between insect pests and their host plants was undertaken at the Delhi University together with a study on the systematics and biology of rats.

A co-ordinated plant virus research scheme for the eastern zone was undertaken by the Indian Agricultural Research Institute in West Bengal and Tripura, and measures to control the same in a few cases were recommended.

Schemes for investigations into fundamental and applied aspects of soil science initiated by the Council were undertaken by the various universities and the State research stations. This involved a study of the climatic influences on crop production, investigations into farm practices, operation of model agronomic experiments and coordinated schemes on simple fertilizer trials on wheat disease control, green manuring and fertilizer demonstration on cultivators' fields.

Studies on improved cultural methods and diseases of tuber crops were continued at a number of places.

Horticulture

Studies on biology, culture, hybridization, preservation, etc., in mango, banana, citrus, guava, litchi, papaya, grapes, temperate fruits and a number of other fruits were undertaken by departments of agricultural or horticultural research stations in different States and the Indian Agricultural Research Institute.

Studies on spices and miscellaneous crops with a view to improving them were continued.

Agricultural Implements

A survey for indigenous agricultural implements was sanctioned for 14 States and a coordinated scheme for trial of imported and improved agricultural implements was undertaken in all the States except West Bengal.

Commodity Committees

The Indian Council of Agricultural Research in collaboration with the Indian Central Cotton Committee and the Indian Central Oilseeds Committee initiated a scheme for intensification of regional research on cotton, oilseeds and millets, and established nine centres and eight sub-centres for this purpose in different parts of the country.

A study on breeding of maize was continued at the Indian Agricultural Research Institute, New Delhi, Hyderabad and Srinagar, and at a few other sub-centres. The Indian Agricultural Research Institute also conducted four-month practical training classes for members engaged in these studies. The Indian Lac Research Institute continued the research on entomology and chemistry of lac. Various studies towards improving of coconut were continued at the Coconut Research Station in South India. The Indian Central Arecanut Committee continued to organise the agricultural and technological research on arecanut cultivation. Cultural and other improvement studies in tobacco continued on a vigorous scale at the Central Tobacco Research Institute. Jute development schemes continued to function in U.P. and eastern India. Fundamental and applied research on jute, ramie and other substitute fibres ; and training on improved methods for jute cultivation was imparted under the auspices of the Central Jute Committee which continued to publish a monthly jute bulletin. Fifty-four research and 22 seed multiplication and distribution schemes in cotton were in operation in different States during this period.

Animal Husbandry

A coordinated scheme on selective breeding versus grading up of cattle continued in Orissa, West Bengal, Bihar and Madras. Cross-breeding of cattle in hilly and heavy rainfall areas continued in a few States with the object of determining the possibility of improving the milk yield and to create dual-purpose animals. The Central Artificial Insemination Station at Bangalore maintained a number of Indian and foreign breeds and supplied about 2,041 semens to various centres. Artificial insemination showed in various States a steady increase in production of better cattle. Studies in cattle sterility were continued at the Indian Veterinary Research Institute and a few other centres, and surveys were conducted in a few villages for examination of animals for various breeding defects. A study on physiological genetics on different breeds of Indian cattle under adverse climatic conditions was continued at Haringhata, West Bengal. Works on problems relating to genetics of cattle continued at Indian Veterinary Research Institute, Izatnagar. Studies on improving sheep for wool in different areas were undertaken by the various States. Goat improvement schemes continued to function in U.P. and Bombay. The poultry development scheme involved a study of distribution of better varieties of chicken and other aspects of poultry. Such schemes were carried out in Kerala, Bombay and in the Indian Veterinary Research Institute, Izatnagar.

Investigations into diseases of cattle, sheep, goats and poultry etc., were undertaken in nearly all the States and Indian Veterinary Research Institute, and necessary steps for control were taken at a number of centres.

The Rinderpest Eradication Scheme continued in different States. Work on mass-production of vaccine and mass vaccination of animals in the States covered by this scheme was pursued vigorously.

Surveys of bacteriological quality of milk continued at Delhi and Bombay.

Experiments on determination of nutritive values of feed straw were continued. The study of trace elements on health of cattle was continued at the Indian Veterinary Research Institute. A study

on the degeneration of cattle in humid climate was undertaken at Calcutta and Hissar. Utilization of waste products as cattle feed was carried out at some centres and a study of urea as protein substitute was conducted at the Indian Veterinary Research Institute.

Studies on improvement of industrial leather were continued. Studies on processing of inedible or unpopular fish were continued at Calcutta, and towards improving the honey yielding capacity of the Indian bee at Coimbatore.

Statistics

The Statistical Branch of the Council continued its advisory work relating to the design of agricultural and animal husbandry experiments and interpretation of other results. The technical programmes and annual reports of the various schemes sponsored by the Council were also statistically analysed. The post-graduate training in agricultural statistics was continued. A short-term seminar in statistical methods was held for the benefit of senior agricultural research officers in different States and research institutions, and some lectures were arranged on recent developments in design of experiments. Training in sample survey and agricultural statistics was imparted to a few foreign trainees deputed by F. A. O. A large number of students and officials from the various States who visited the Council were acquainted with training and research work undertaken by this branch.

Agricultural and Veterinary Education

Financial assistance was given to the Uttar Pradesh Government for establishing an Agricultural University at Rudrapur. A refresher course in Pharmacology was held at Lucknow for teachers in veterinary colleges. The third session of the Indian Council of Agricultural Education held at Bangalore recommended a number of important improvements in the present set-up of the agricultural and veterinary colleges in India. A second Joint Indo-American Team on Agricultural Education, Research and Extension was established to evaluate research in this field and make recommendations for its improvement during the Third Five Year Plan. To meet the shortage of trained veterinary personnels, financial assistance was given to State Governments for running two-year emergency courses in veterinary science. The Centre also provided financial assistance for development of a number of agricultural and veterinary colleges in the Punjab, Madras, Bihar, Uttar Pradesh and Bombay.

Agricultural Information

The Council continued to publish a number of scientific journals, monograph, bulletins and pamphlets. On the non-technical side, publication of 'Indian Farming', 'Indian Horticulture' , 'Khet' (Hindi), leaflets, bulletins and pamphlets (English and Hindi) was continued.

The Animal Health Information Service was continued.

Library

Several new services were initiated and there was considerable increase in library activities. Dr. Shaw's recommendations on reorganization and development of library were implemented.

Chapter I

ADMINISTRATION

General

This is the 29th annual report of the Indian Council of Agricultural Research presenting a general review of the activities of the Council during the year 1958-59.

OFFICIAL CHANGES

During the period under report,

1. Dr. S. M. Sikka took over as Additional Agricultural Commissioner *vice* Dr. R. J. Kalamkar who reverted to the Government of Madhya Pradesh.

2. Shri S. N. Mohan took over as Deputy Livestock Adviser *vice* Shri K. P. R. Kartha who retired.

3. Shri J. S. Bali, I.A.S., took over as Additional Secretary, Indian Council of Agricultural Research *vice* Shri F. C. Gera who was transferred to the Central Tractor Organisation.

Towards the end of the year, Shri Bali was transferred to the Department of Agriculture and Shri Prakash Krishan, I.A.S., took over as Additional Secretary.

ALLOTMENT OF FUNDS

The Council which influences agricultural research in cooperation with States, universities and private institutions sanctioned the continuance of 100 current schemes at a cost of Rs. 24.87 lakhs (Appendix I). During the year it also sanctioned 161 new research schemes in agriculture, animal husbandry, statistics, etc., with an allotment of funds to the extent of Rs. 31·92 lakhs (Appendix II). Forty-two schemes terminated during the year (Appendix III).

FINANCE AND ACCOUNTS

The following were the receipts from (i) the cess levied under the A. P. Cess Act, 1940 ; (ii) the grants received from the Government of India; and (iii) grants from other sources.

	Rs.
I. Receipts from the Cess	43,31,737
II. Grants From the Government of India	
1. Rinderpest eradication—preparation of propaganda material.	30,000
2. Manurial and agronomic trials.	70,000
3. Supply of information and literature to village level workers	6,11,000
4. Wheat rust control	5,210

	Rs.
5. Weed control	1,790
6. Co-ordinated cattle sterility	56,770
7. Study of milk yield, breeds and management practices of bovines in the north Gujarat and Saurashtra part of Bombay State of India	95,000
8. Ascertaining the cost of milk production	78,000
9. Establishment of a research-*cum*-testing Centre for bullock-driven agricultural implements, Indian Agricultural Research Institute	10,000
10. Production of agricultural films	1,40,000
11. Research and development of pepper and cashewnut	10,100

GRANTS FROM OTHER SOURCES

1. Co-operative Film Production Unit, Rajasthan	70,000
2. Co-operative Film Production Unit, Assam	30,000

A statement showing the audited accounts of the Council for 1957-58 is appended in Appendix IX.

MEETINGS

Sixty-three meetings of various bodies of the Indian Council of Agricultural Research were held during the year (Appendix IV).

Chapter II

AGRICULTURAL RESEARCH

BOTANY (*Physiology*)

Presoaking Seeds in Nutrient Salts

Indore. It was found that the quantities of the major nutrients originally present in cotton seeds and paddy grains were very high and the seed-soaking treatment caused a very slight increase in these quantities. Thus this treatment could be of little utility in promoting better growth. The minor elements behaved differently; their presence in cotton and paddy could not be ascertained. However, they were observed to penetrate the kernels in small amounts. This might prove useful in soils with a deficiency of such micro-elements as copper, chromium and manganese.

New Delhi—Indian Agricultural Research Institute. Chemical analyses of water extracts after soaking the seeds of wheat, rice and cotton at room and low temperatures (10°C.) were undertaken. The periods of soaking varied from 6 to 24 hours and the ratios of seed-mass to water-volume from 1:10 to 1:3. Details are summarised below.

Wheat grains. The quantity of reduced sugars diffusing out of seeds increased with increase in the length of soaking period and temperature. By lowering the ratios of seed-mass to water-volume, there was slight decrease in the quantity of non-reducing sugars diffusing out, whereas reducing sugars were not effected. Greater loss of sugars from seeds during soaking appeared to be associated with lower germinating capacity of seeds.

Besides sugars, four amino acids, *e.g.*, histidine, leucine, valine and serine were also identified in the water extract when soaked at room temperature for 24 hours.

Cotton seeds. Both reducing and non-reducing sugars diffused out of seeds to a more or less similar extent and increased with increase in length of soaking period.

Seeds of wheat and cotton were soaked in various concentrations of zinc sulphate solution for 24 hours at room temperature with 1:10 ratio of seed-mass to the volume of solution. After germination of the seeds zinc content of cotton seedlings and their test was found to be higher.

Paddy grains. The quantity of total soluble substances (including reducing sugars) and the ash content of water extract increased with increase in length of the soaking period. Non-reducing sugars, however, did not appear to be present in the diffusate. Wheat behaved similarly.

The germinating capacity of cotton seeds after soaking in various concentrations of zinc solution was not affected while it was affected in case of wheat seeds.

Uttar Pradesh—Vivekananda Laboratory, Almora. Two-gram samples of mustard T.102 were soaked in 100 and 200 ml. each of glass distilled water (G.D.W.) and M/100, M/50 and M/10 of potassium di-hydrogen phosphate, magnesium sulphate and calcium nitrate for six hours at a constant temperature of 25°C. No significant difference in percentage germination of different seed samples was observed. Seeds soaked in glass distilled water and M/50 Ca $(NO_3)_2$ for six hours gave significantly higher germination. There was no significant difference in germination of seeds soaked for different periods in KNO_3.

Maize grains when soaked in various concentrations of Ca $(NO_3)_2$: M/100 and M/50 Ca $(NO_3)_2$ for six hours also showed a higher germination percentage.

Plant introduction in a temperate region and studies in physiology of plants (Vivekananada Laboratory, Almora).

Plant introduction. Kanawari and B.R. 12 varieties of peas appeared to be most promising. The grasses, *Paspalum* sp., *Andropogon* sp., *Ischaemum* sp. and *Cynodon Plectostachyum* (giant star grass) were found to be high yielders. The latter proved good in soil conservation. Hybrid onion seeds were also successful. Seeds of improved varieties of wheat, milo and onion were multiplied and distributed among the farmers together with vegetable seeds of hush beans, okra, tomatoes, propagating giant star grass, love grass and kudzu.

Physiology, Maize. The growth of pollen grains was optimum in 12·5 per cent surcose solution. Incorporation 2 p.p. m. of 3-Indolepropionic acid in the germination medium induced maximum elongation of pollen tubes.

Wheat. Pollen could not be germinated on any suitable liquid medium. However, incorporation of 10 p.p.m. boron (as boric acid) in 1 per cent sugar and 17·5 per cent sucrose stimulated the growth and elongation of pollen tubes.

Madonna lily. Maximum length of pollen tubes was observed in sucrose. (1480 microns); incorporation of glutami acid 0·025 p.p.m. in this medium induced further growth and elongation of pollen tubes.

Sweat pea. Pollen tubes showed maximum stimulation and growth after incorporating extracts of cuscuta in acetone : water (1:1) medium.

Protoplasmic studies. Protoplasm of pollen tubes of madonna lily was used for these observations:

(1) In 50 p.p.m. cystine media, pollen tubes showed good cyclosis ; (2) in 12:5 per cent sucrose containing 0·025 p.p.m. arginine they exhibited very slow cyclosis, showing increased viscosity of protoplasm ; (3) in media containing 0.25 p.p.m. glutamic acid they showed quite slow cyslosis ; and (4) migration of the protoplasmic particles in pollen tubes germinated in the above media was observed by using micro-electrodes and the cataphoretic. The particles in the tubes were negatively charged since all of them migrated towards the anode.

Identification and Estimation of Amino-acid Contents in the different portions of Control and Vernalised Seeds of Mustard

Descending chromatographic technique was used for this experiment. Both in control and vernalised seeds, the concentrations of amino-acids were higher in cotyledons and embryos in comparison to testa. The number and concentration of amino-acids in general were greater in case of different portions of vernalised seeds ; only the vernalised seeds were positive for proline.

Cystine was detected from third to ninth leaf of the vernalised and fourth to the ninth leaf of the control plants ; Lysine-histidine was present both in control and vernalised samples ; the areas of glycine spots from sixth to the tenth leaf were greater in vernalised samples, the spots of aspartic acid, glutamic acid and theornine were generally higher in the control than those in the vernalised samples ; alpha-and-beta-alanine amino acid contents were generally greater in all leaves of vernalised samples than in controls. Regarding methionine-valine and tryptophane amino acids, except in the first leaf, the areas of the spots in the chromatogram of vernalised samples were generally higher than in the controls. Spots of amino-n-butyric acid appeared in the chromatograms of both control and vernalised leaves.

In experiments on wheat and barley, there was no correlation between the vegetative phases and content of amino-acids in them.

Storage and Viability of Pollen Grains and Physiology of Pollen Tube Growth (Delhi University)

Optimum temperature and the effect of *p*H on pollen germination and tube growth varied considerably from species to species and even within a species itself. hTe *p*H of the medium did not affect either the percentage of germination of the tube length ; nor could growth curves with two peaks observed.

Pollen of *Cajanus cajan* remained viable for seven days at 5°C. over 34 per cent RH and gave 30 per cent fruit-set in comparison to 64-67 of fresh pollen.

Chemical Stimulation of the Ovule (Delhi University)

The stimulant requirements of ovules of plants considered were not same. The ovules of Papauer matured and even produced seedlings on the basic medium itself; those of *Argemone* failed to attain

differentiation or maturity on all media tried. No marked improvement in growth occurred by the application of growth-promoting substances like gibberalic acid, indoleacetic acid and 2,4-dichloro phenoxyacetic acid.

Artificial induction of parthenogenesis was obtained by inducing a zygote to divide earlier than usual. The possibility of inducing development in unfertilized eggs in a favourable medium is hoped for.

Application of Synthetic Plant Hormones (Bombay)

Hormone-treated crops showed precocious and vigorous growth in earlier stages, but at maturity the entire crop became almost uniform ; the grain yield was more or less similar to that from the untreated plots.

RICE

Rice-breeding Schemes

In Coorg, among medium duration varieties tried, *M.* 141, *S.* 317, S.L.O. 1, *G.R.* 7 and Sc 1117/36 ; from long duration varieties, T.K.M. I and ; out of various cultures of Mambilia tried, *M.B.* 319 and *M.B.* 321 gave higher yields.

In the Punjab, Kolamba 181 of Bombay showed better adaptability than others.

In Kashmir, 60 per cent of the selections from *indica* × *japonica* (corn combination for non-shedding, resistance to blast and high-yield character) came from Rikhu 132 (*japonica*). Among the *indica* parents, Ch. 47 was better. Types AC 529, AC 534, AC 2491, AC 1344, Norin 6 and Ch. 1038 proved non-shedding. No symptoms of blast were observed on the Russian variety, R 2852.

None of the types, *viz.*, Basmati 3,370, Mushkan 7 (Cuttack), 41 (Punjab) and Dudshar (Bengal) though found resistant to stem rot, seemed suitable for direct introduction in Kashmir as they flowered very late.

Among the various trace elements and their combinations tested in Coorg for controlling blast in paddy, none proved effective.

Resistant Varieties Carried in Various States

These schemes are operating in West Bengal, Assam, Uttar Pradesh, Madras, Mysore, Kerala and Andhra Pradesh.

In Kerala, the varieties Kolappala, Pokhali and Karivennel were found resistant to salinity and the variety HBJI proved to be good in deep water. In Assam, varieties Negheri and Panikekoa were found superior to others for deep and shallow water, respectively. In West Bengal, the varieties Bokra and Rupral, for the early group and Talmugur and Nona-bhelki for the late group, were found very promising regarding salt resistance and yield. F.R. 13 A and F.R. 13 B were flood resistant, promising and high yielders. Amongst the salt-resistant types, Kumargore, Sadamota and Malabati were also found

resistant to submergence. In Andhra Pradesh, among the short duration varieties, Red Kesari and Buddamolakolukulu recorded significantly higher yield at the concentration of 0·405 per cent and 0·494 per cent of salts, respectively. Of the deep water cultures tested, culture 1311 continued to maintain its superiority over the others.

Breeding Strains of different durations of Paddy Resistant to Piriculeria

Madras (i) *Coimbatore.* Among the short duration cross combinations, four cultures of the cross Co 22 and Co 4 and two of cross Co13 and Co4 were promising. Of the medium duration group, culture 6538 of cross GEB 24 and Co4 was a good yielder and highly resistant to blast. During monthly planting trials, the short duration strains planted in October, November and December were severely affected. (ii) *Adhuthurai.* The disease incidence was rather negligible and selections were not undertaken.

Andhra Pradesh. Six promising blast-resistant cultures, *viz.*, 2902, 5352, 5390 and 5392 of long duration, 6517 and 6522 of short duration, were found to be promising and were passed on for trial on cultivators' fields in Nellore district.

Bombay. Eighteen isolates of the fungus, *Piricularia oryzae,* were tested against 18 paddy varieties for leaf infection. Marked differences in respect of virulence appear amongst the isolates tested. On the basis of leaf infection, the isolates were divided into three groups—weak, intermediate and virulent.

Chemical Investigation of the Cause of Blast Resistance in Paddy (Madras)

The scheme started on April 18, 1958, and results of the investigations are yet to be analysed.

Breeding Drought-resistant Strains of Paddy

Madras. At Coimbatore, strains *TKMI, MTU* 18, *ASD* 4 and varieties Arunjothi, Chomala and Peddakonda hill paddy gave outstanding yield and resistance to drought. Two outstanding cultures 8405 and 9754 of cross *GEB* 24 were advanced for district level trials. At Tirurkuppam, progenies of crosses *GEB* 24 × *T.* 260 and *Co* 13 × *T.* 469 were found to be quite promising.

Root studies showed that drought-resistant strains like *TKM* 1, hybrid culture 9756 (*GEB* 24 × *T* 260) and wild species *O. minuta* ($2n$=48) had elaborate root systems, greater depth of penetration and higher root-shoot ratio. No significant differences either in the spacing of stomatal rows or in the frequency of stomata between the drought resistant and susceptible types were, however, found.

Kerala. Fifty-seven cultures from F.6 progenies of crosses between Krasnodar, a Russian drought-resistant variety and Kottamodan (PTB.28) were selected. Ten hybrid seeds of the back cross (Krasnodar × Kattamodan) × Kattamodan were grown and studied.

Evolving Improved Strains of Paddy under Lift Irrigation (Andhra Pradesh

Among short duration varieties, SLO 19 recorded the maximum yield of 1,115 lb. per acre. Culture 10022 and the varieties *BCP* 1 and *BCP* 4 were found to be high yielding among the medium and long durations groups, respectively.

Rice Stem-borer Schemes

West Bengal. Significant variation in percentage of infestation by *S. incertulas* in different varieties was noticed. No significant variation occurred in varieties of *aus* paddy. Sowing of *aman* paddy up to 15th June escaped partially the infestation of the stem borer. Crops sown from September 15 to October 20 seemed to be most vulnerable. In *aus* paddy, seeds sown on June 23 were subjected to the maximum attack. Crops sown during July 17 to August 8 were most vulnerable to the attack.

The application of insecticides as prophylactic measure had a direct bearing on the protection of both the *aman* and *aus* crops of paddy from damage. Higher dosages of 'endrin' gave better protection while 'parathion' was equally effective at lower and higher doses. However, 'parathion' proved more effective than 'endrin.'

Andhra Pradesh. (1) *Rudrur* : Six *abi* paddies RDR 7, CH 45 (short), RDR 2, HR 19 (medium), RDR 4 and HR 35 (long) showed that except for the variety RDR 7 transplanting in the fourth week of June was the best for all of them. RDR 7 gave better yield after transplanting in third week of July. During the *tabi* season, five weekly sowings started from the third week of December but only those sown during the third and fourth week of January produced a better yield.

Trap-crop of paddy in nursery reduced the bored-ear production in variety HR 19 at harvest by 1.16 to 1.93 per cent.

Spraying with folidol 0.03 per cent, 0.06 per cent and 0.12 per cent, and endrin 0.0215 per cent, 0.031 per cent and 0.043 per cent resulted in reduction in the number of bored ears. Nevertheless, increase yield was not statistically significant in both *abi* and *tabi* crops.

Studies indicated roughly five broods of the pests, three in *abi*, and two in *tabi*, the last brood in *abi* occurring in October-November. Two of *tabi* occurring in December-January and March proved more destructive.

(ii) *Bapatla.* A planting up to July 19, was found to be the best time for monsoon paddy and the first week of February for the summer paddy in regard to infestation and yield. Removing of egg-masses in the paddy nurseries at Maruteru had no effect on the subsequent infestation in the planted field. The treatment of trap-crop of paddy in the nursery was not helpful as a control measure against the stem borer. In monsoon crops, 'parathion' gave a better control of the borer at Samalkot and Buchireddipalem, while 'endrin-

proved better at Maruteru and Pulla. During summer, 'endrin' gave uniformly higher reduction in the incidence of stem borer and higher yields of rice than 'parathion' at all the centres tried.

Madras. Among the varieties ADT 1. ADT 2, ADT 8, ADT 25, Co 19, and Co 25, Co 19 and Co 25 were found superior in yield and infestation.

Studies in the time of sowing and incidence of attack showed that the third-week sowing was the best among the four weekly sowings starting from September 14, and that mechanical removal of egg-masses gave significant yield difference between the treatments. Raising trap--crop before *kuruvai* crop had only limited influence over the two succeeding crops, *viz., kuruvai* and *samba.* 'Folidol' 0.1 per cent and 'endrin' 0.043 per cent were effective in lessening the incidence of attack.

Six broods of the pest were obtained and the life-cycle was worked out. Egg period lasted for eight days ; larval period for 19 to 20 days ; pupal period for nine days ; and adult life for two days.

Stem Rot Disease of Rice (Madras)

Soil drenched with 0.1 per cent of Ceresan controlled stem rot. Incidence of the latter was not affected by different levels of water in paddy fields or through treatments of N.P.K. at three levels.

WHEAT

Co-ordinated Wheat Rust Control Schemes at Centre and in the States

Centre. At Delhi the varieties E 2842 and E 3133 were found resistant to all races of black rust. Variety E 2025 was found resistant to all the races of brown rust, while E 3099 and E 2839 were resistant to all races of yellow rust. In yield, the new varieties N.P. 823 and N.P. 824 were outstanding. In small-scale trials, selections of the cross. (Rionegro × N.P. 760) F_7 appeared promising in their resistance to rusts, good yield and grain quality.

A number of intervarietal, inter-specific crosses and back-crosses were effected for introducing rust resistance and other desirable characters in the wheat strains.

In yield trials at Pusa, N.P. 7 co and 8 co series, varieties N.P. 824 and N.P. 822 appeared to be very promising. Crosses were attempted with the object of incorporating resistance to one or more of the rusts and other desirable characters in improved N.P. wheats adapted to local conditions. Inheritance studies undertaken revealed a complete lack of association between the inheritance of resistance to rusts and morphological characters.

At Simla, varieties N.P. 770, N.P. 809 and Ridley were outstanding. N.P. 824 showed promise in the lower and N.P. 818 in the higher hill areas.

Varieties I.D. 6, I.D. 8, I.D. 7, I.D. 23 and I.D. 22 (amber grained), I.D. 28, I.D. 31 and I.D. 38 (red grained) among durums and I.V. 5 and I. V. 7 among *vulgares* were found to be high yielders at Indore.

The new brown rust resistance dicoccum selection P.D. 13 was given the number N.P. 200. It was multiplied for distribution from the Willington Centre.

A number of strains resistant to Yellow, Brown and Black rust, and loose and covered smut were built up by hybridization for further detailed studies.

States. (i) *Madhya Pradesh.* The incidence of rust was generally very low due to dry and clear weather. In all 39 new crosses were attempted in *durum* and *vulgare* varieties. Progenies of crosses Ridley E. 572 × H. 65. E. 581. × Hy. 65 in F_3, crosses of Hy. 277, Hy. 2-1-1, Hy. 14 and Hy. 18 with N.P. 790 (St. 88) in F. and Hy. 65 × N.P. 790 in F_5 proved highly resistant. Of the early-ripening rust-resistant cultures, Hy. 65 gave the highest yield.

(ii) *Punjab* (*Gurdaspur*). The strain C. 286 out-yielded C.250, the recommended strain, by a significant margin and was also highly resistant to all the three rusts. Under rich land conditions, the new strain W. G. 5, excelled the approved strain C.518 as well as C.273 significantly. Another two strains, *viz.*, 18-25-8 and C.299 proved promising for late sowing. Exotic types, *i.e.*, Rio Negro, Centeria, Frontana, C.O. 4996-97, E 2546 and F 2564 established their superior resistance to all the three rusts. Back-crosses with these types gave rise to some of the highly promising cultures which excelled even 286 by nearly 50 per cent.

(iii) *Bombay* (*Niphad and Badnapur*). In co-ordinated trials at Niphad on cultivators' fields N-125 gave better yield than the local in East and West Khandesh. N-59 was outstanding in Nasik district. As regards irrigated wheat, N-345 recorded higher yield than N.P. 710 at Kaira, Broach and East Khandesh. However, at Baroda and Ahmedabad, N.P. 710 gave better performance than the other improved strains of Bombay State. Other important varieties of irrigated wheat were K-25, Hy. 65, MHD-465 and Gaza derivatives Nos. 754 and 375.

At Badnapur none of the N.P. wheats tested were superior in yield to PW 5 under rainfed conditions and even under irrigation when black stem rust did not appear. However, when stem rust appeared early and in epidemic form, N.P. 758, N.P. 718, N.P. 710, N.P. 721 and N.P. 52 seemed to do well. Varieties K.C.N. 179, M.H.D. 345 and Hy. 65-4 also showed some promise.

West Bengal (*Tollygunge*). In regional trials with different varieties, N. P. 710 gave satisfactory yield both under irrigated and unirrigated conditions. Of the hill varieties studied at Kalimpong, H.D. (52)-66 and H.D.(53)-146 were very good yielders under hilly conditions.

Uttar Pradesh. Two varieties N.P. 813 and E 1913 were found to be tolerant to black, brown and yellow rusts at Kanpur under artificially created epidemic conditions. Under similar conditions at Jeolikot (Nainital), all the varieties tested showed susceptible reactions.

During natural infection at Kanpur, Hawalbagh, Varanasi, Meerut, Phoolbagh and Amrokh, none of the varieties escaped completely from attack of the three rusts. However, N.P. 798 was better tolerant at Hawalbagh.

Survey on the incidence and severity of different rusts of wheat and barley was carried out in 15 districts of U.P. Varieties C 13, Pb. 591, N.P. 710, N.P. 125 and N.P. 718 were found lightly to moderately affected with all the three rusts.

Here reactions of wheat varieties and hybrids supplied by the Wheat Breeders from Bombay, Mysore, Andhra Pradesh and Madhya Pradesh States were tested against black stem rust both in the seedling and adult stages in the field and results are summarized below:

Bombay. Two Israel durum wheats were found to be resistant to R 15C to which Gaza wheat is susceptible. Among the material from Niphad, crosses in early generations between Kenphad 25 and 28, between N.P. 715, and K.G.P.F. 4508 and those of Gaza with B.-23, Vijay and Gulab in advanced generations had yielded more resistant selections than from others. The crosses P.W. 5 × N.P. 790 and of Gaza with P.W. 1, 3 and 7 received from Badnapur were found to be promising. The cross Gaza × N. 8-12-13 in F_7 had yielded the largest number of uniformly rust-resistant cultures as compared to other cross received from Kopargaon.

Madhya Pradesh. Crosses of St. 88 (N.P. 790) with different semi-resistant varieties yielded a large number of uniformly resistant selections in F4 and F5. Crosses Ex. 130 × A.098 in F9 and Ex. 130 × N. 168 in F10 were also promising for rust resistance.

Mysore. Five selections from cross Gaza × 39-1 were found to be uniformly resistant in the seedling tests. In the field however, four of them showed segregation for susceptible plants which was presumably due to the presence of a virulent isolate of 42B. Among the material received from Annigeri, crosses Gaza × Jay and R.W. 'B' × Gaza × R.W. '40' were promising for rust resistance. Crosses Athani × Gaza and Gadag × Gaza, both in F_6 were promising for rust resistance.

MILLETS

Improvement of Bajra and Agronomic aspects of Jowar (Bombay)

Bajra (*Saurashtra*). Of the various varieties of *bajra* collected from other States, none was found suitable. Further all the outside varieties were very late, except C-10-2. Selection was, therefore, restricted to local material only and five strains of *bajra, viz.*, N-28-15-1 N-28-15-2, S-14 and L-11, and one of *jowar* namely E-56A were evolved.

Out of five improved strains of *bajra,* three strains N-28-15-2, N-28-15-1 and R-2 of different maturity groups were found suitable for assured rainfall tract of Saurashtra (Sorath and Gohilmad districts and some parts of Madhya Saurashtra) while the remaining two strains S-14 and L-11 were found suitable for Halar and Zalamad districts due to their shorter maturity.

Jowar (*Amravati*). Of the different methods of application of manures, placement proved effective. Manures applied with sowing and application of 20 pounds N as A.S.N. with 20 pounds P_2O_5 per acre gave good results.

Sowing by tiffan keeping seed-rate as in *phulli* appeared to give goods results. An 18-inch spacing between lines was effective.

Control of Striga *on* Sorghum (*Jowar*)

Evolution of strains of *sorghum* resistant to *striga* were attempted by selection and hybridisation. Selections 298 and 308 of N. 1. A.S. 4003 and 234/1 of N. 3 × A.S. 4003 were on par with A.S. 4003 in *striga*-resistance and in yield to the respective local parents.

Spraying with fernoxone and agroxone did not produce extra yield, and proved costlier than hand-weeding.

Various agronomic methods to control striga proved ineffective.

Studies in Smut Disease of Bajra Anand (Bombay)

Benzaldehyde, potassium permanganate and copper sulphate in concentrations of 1 p.p.m. and above did not stimulate germination of teliosporos. Germination of Spores was unaffected both in diffused light and in absence of light ; direct sunlight retarded germination.

Smut fungus grew better in the presence of sucrose, glucose, galactose, dextrin, mannose, sorbitol, aspartic acid, asparagine acid, glutamic, casein and peptones. Nitrogen in the form of potassium nitrate appeared to support better growth than the rest of the salts. Among vitamins, thiamine was found to be essential for the growth of the smut fungus. *Past* leaf was found to be the best stage of infection in *bajra* by the spores.

The fungus was not seed-borne. The spores remained viable in soil when buried from 3″ to 9″ depth. Higher temperatures after March, in the upper 3″ layer of soil, was not favourable for spores. The local varieties, *viz., bajra* local, S. No. 297, Jamagari Giant and Alsola were susceptible to smut. Multiplication and distribution of Hybrid *bajri* was undertaken at Nasik and nuclear seeds of the two parents : 28-15 and AF_3 were multiplied and Ca. During the year 1572 maunds of hybrid seed were produced.

A hybrid *cumbu* (*bajra*) scheme was under way in Madras and in the yield trials, two short and four medium duration inbreds were found significantly superior to standards. Co_2 and Co_1, respectively. A number of short and medium duration inbreds were top-crossed with Co_2 and C_3 to judge their combining ability. On the basis of the top-cross performance, inbreds were chosen for effecting single crosses. Two short duration hybrids H.442 and H.886 gave better performance than the local varieties.

PULSES

Pulse Improvement Schemes in States

Madhya Pradesh (*Khargone*). *Tur*: Khargone A53-10, Khargone 56-135, Bhikangaon A53-658 and Bhikangaon A53-303 of *tur* showed promise. Hybrids 37 and 38 of *mung* were found promising. Out of 42 pure line selections, Khargone 56-115 gave the highest yield of 873 pounds per acre. Out of 38 pure line selections of *urid*, strain

Kharegone 56-71 gave the highest yield of 920 pounds per acre. In a varietial trial, local Nimari and Ujjain-4 gave the highest yield of 469 and 439 pounds per acre respectively. Hybrid 257-1 and Ujjain-21 of gram gave the highest yield.

West Bengal (*Berhampur*). Out of 58 cultures of *arhar*, No. 13 gave the highest yield. Results of a mixed cropping trial indicated that *arhar* and paddy could be grown in association with advantage.

Among early types of *mung*, West Bengal collection No. 1 gave the highest yield. Selection No. 77 of lentil gave the highest yield. Selection No. 97 was found to contain the maximum protein content (Ca 31.74 per cent). In yield trials, three types C.T. 31, No. 77 and No. 2 gave more yield than the 'locals'. Among the improved types of gram obtained from other States, type S.T. 4 from Bihar gave the highest yield both at Berhampur and Kalyani farms. The last week of November was found to be the optimum time for sowing in West Bengal.

GRASSES AND FODDERS

Central Grassland Reconnaissance Survey Scheme, Jodhpur

Twenty-eight sites were surveyed in the temperate and Alpine regions of West Bengal and Vidarbha region of Bombay State. The sites from Vidarbha belong to *Schima—Dicanthium* type.

The presence of a number of temperate grass species like *Calamogrostis, Agrostis, Poa, Phelum, Festuca, Muchlem bergia, Bromus, Holeus* along with recognised tropical and sub-tropical grass species suggested the occurrence of an entirely new grassland type in the temperate regions. This type is under study.

Cytogenetics of Wild Grasses and their Breeding for Selective Fodder and Forage grasses (*Coimbatore*)

Collection and identification of 45 species belonging to 24 genera of grasses was completed and their morphological features recorded. Cytology was studied in *Brachara ramosa* ($2n = 36$), *Chloris barbata* ($2n = 40$ and *C. gayana* ($n = 10$), *Panicum maximum* ($2n = 36$) *Urchola reptans* ($n = 7$) and *Urochloa mosambicensis* ($n = 14$).

Interspecific hybridisation between *C. Ciliaris* and *C. glaticus* proved sucessful, the hybrid being fertile.

Research on Fodder Production and Pasture Grasses

The scheme for fodder continued to operate in Madhya Pradesh, West Bengal, Bihar, Mysore and Andhra Pradesh. It was further sanctioned for Kerala from April, 1959. Scheme for the improvement of pasture grasses and legumes continued to work in Madhya Pradesh, Bombay, Mysore, Madras and at the Indian Agricultural Research Institute, New Delhi.

Fodder Research

Madhya Pradesh (*Bhopal*). Under irrigated conditions Napier (tall), *Dicanthium caricosum* (*medium*), *Chionachana hartata* and *Dicanthium annulatum* (lower); three *jowar* strains N.J. 156, P.4 and

Pelia (tall); and grasses: *Ischaemum pilsom, Iscilema laxum* and *Cymbopogon martnii* (medium) proved promising. Under rainfed conditions, *Sorghum purpuriocericious, S. sudanensis* (tall), *Pennisetum pedecellatum* (medium), *Schima sulchatum,* and *Iscilema laxum* (lower) were promising. Of the annual legumes, *Mucna cochinchinensis* and *rawa* gave superior yield. In manurial trials, the best treatment appeared to be 40 pounds N and 40 pounds P per acre.

Among grass and legume mixtures, *Sorghum purpuriocericious* and *moth* were the best.

West Bengal (*Calcutta*). Of the various *kharif* legumes, *Crotolaria juncea, Phaseolus* sp. IC 26, *Glycine maso* EC 58, and *Cyamopsis tetragonoloba* EC 60 were quite promising. In drought resistance, *Vigna* appeared the best.

Among perennial legumes, *Indigofera endecaphylla* gave better performance. Under irrigated conditions among *rabi* legumes *Medicago sativa* followed by *Trifolium alexandrinum* and varieties like *Pennisetum polystachyam, P. brizantha, Cenchrus ciliaris* and *H. rufa* proved to be high yielders, whereas under unirrigated conditions *Pennisetum polystachyum* followed by *Napier* and *H. rufa,* gave the highest yield. In *rabi, Secale cereale* produced the highest yield.

The perennial grass legume mixture *P. dilatum* + *C. mucuno* gave the best performance.

Mysore (*Coorg*). Among various grasses and legumes studied, *Panicum colaratum, Setaria sphacclata,* giant rhodes, *Dicanthium carisosum* and *D. annulatum* were promising. Amphidiploid of *Cumbu* × Napier was promising; the legume collection *kudzu* was superior. Napier and *kudzu* made good silage.

Madhya Pradesh. In a yield trial para and Rhodes gave higher yield than the others. *Pennisetum Accidum, Panicum antidotale,* thin Napier giant star, *Dicanthium annulatum* and *Cenchrus ciliaris* proved drought resistant, while para. Napier, Guinea and Rhodes were found to be well suited for intensive cultivation under irrigation.

The *kharif* annual legumes, *Indigofera glandulosa, Desmodium diffusum* and *Alysicarpus rugosus* were well suited as associates of pasture grasses.

Andhra Pradesh (Rajindranagar). The common legume, *Pillipesara* proved the best, followed by *urid,* cowpeas and *mung.*

Bihar (Shahabad). The results are yet to be assessed.

Research in Pasture Grasses and Legumes

Madhya Pradesh (*Sconi*). Cereal fodder crop (17 cultures of *jowar*), annual rainfed grasses (*Pennisetum pedicellatum, Thelepogon clegans* and *Dichanthium caricosum*), perennial rainfed grasses (*Pennisetum polystachyon* and *Chloris bournei*); and perennial irrigated grasses (*Bracharia mutica* and *Pennisetum purpureum*) were found promising.

In the triple cropping experiment, the mixture of maize plus cowpea in summer and *mung* in *kharif* preceding wheat did not lower its yield in comparison to wheat grown alone ; whereas introduction of maize plus cowpea or *jowar* plus *guar* in summer followed by soyabean or *mung* in *kharif* gave higher yields of grain of paddy than that of paddy grown alone.

In a double cropping experiment under rainfed conditions the introduction of Sudan grass or soyabean before wheat proved to be better than other types. Sweet clover and *lakh* after paddy gave best results.

Of the mixed cropping of leguminous and non-leguminous fodders, superior combinations were: (a) *kharif*: *Pennisetum pedicellatum with popat* (*Dolichos lablab*) ; (b) *rabi* (rainfed): sunflower *with lakh* : *rabi* irrigated : *jowar* No. 7 *with berseem* ; and summe cowpea with teosinte and *jowar*.

Bombay (Poona, Anand, Kosbad and Manjri). Out of 114 marvel grass (*Dicanthium annulatum*) selections. 14 were distinctly promising. Nine F_1 hybrid selections from a cross between African *bajra* × thick Napier were multiplied for further study. Among the grasses, thin Napier at Kosbad and Madras, and *anjan* at Manjri and And proved superior.

Regarding the effect of cuttings on the crude protein content of grasses, the first and second cuttings appeared to be richer, and the same decreased with advance of the season. With an increase in the application of N, the protein content of grasses also increased in general, whereas applications of 20 pounds P alone had a depressing effect.

Mysore (Dharwar). Segregate No. 4 from a cross between African *bajra* × Elephant grass maintained its superiority. In legumes, four selections of *Indigofera glandulosa* and three of *Alysicarpus rugosus* were isolated for further study.

In a manurial-*cum*-varietal trial with different grasses, N. applications showed linear response. The interaction between the applications of N and P did not prove to be significant. Further, thin Napier gave the maximum yield and Rhodes the lowest.

Of the various grass-legume mixtures of *Centrosema* and Blue Panic, and thin Napier and *P. pedicillatum* gave encouraging results. The mixture of thin Napier and *Calapoganium mucunoides* in the ratio of 4 : 1 only gave the highest yield.

Madras (Coimbatore). *Pennisetum purpureum* gave the highest yield of 90.700 pounds per acre. Among the other grasses studied *Tripsacum laxum. Eragrostis superinal. Andropogon intermedius Schima sulcatum* and *Pasapalidium flavidum* under irrigated conditions and *Digitaria poleuansii, Setaria* spp. *Themeda triandra* and *Panicum maximum* under unirrigated conditions continued to be quite successful.

The legumes *Indigofera endecaphylla, Medicago* spp., *Arachis prostrata* and *A. marginata* appeared quite promising under irrigated conditions, whereas under unirrigated conditions *Leucacna glauca, Desmanthus virgatus,* cluster beans, *Indigofera suffruticosa* and *Clitoria ternatea* were successful.

New Delhi (Indian Agricultural Research Institute) *Brachiaria mutica* under sewage irrigation and *Chloris gayana* under rainfed conditions gave the highest yield.

Napier plus *kudzu* grass-legume mixture ranked first.

Coordinated trials were undertaken in two zones. In Zone No. I (Rainfall 500 to 1000 mm), *Chloris gayana, Urochloa mosambicensis, Cenchrus ciliaris, Panicum maximum, P. antidotale,* (grasses), and *Mucna cochin-chinosis, Desmodium purpureum, Phaseolus lathyroids, Dolichos lablob* (legumes) were promising. In Zone II (Rainfall over 1000 mm.) *Brachiria mutica, Setaria sphacelata, Chloris gayana. Urochola mosambicensis, Cynodon plectostachyum* (grasses) and *Mucna cochinchinosis, Phaseoelus lathyroids* (legumes) gave good results.

ENTOMOLOGY

Termite Research Schemes

Taxonomic work on termites was pursued at the Forest Research Institute, Dehra Dun. The Indian Agricultural Research Institute. New Delhi, undertook a survey in Orissa State, and termite specimens were collected from various field crops. Considerable termite damage was observed, particularly affecting sugarcane plants and coconut seedlings. The genus *Cyclotermes* was of common occurrence throughout the State.

In cotton fields 5 per cent DDT and 5 per cent BHC at the rate of 15 to 20 and 25 pounds per acre, proved effective against termites. The insecticidal dust mixed with soil and placed in the furrows at the time of sowing was also effective.

A technique for rearing termites in a laboratory was perfected, thus enabling closer observations on their different types.

In studies at Anand in Bombay State 5 per cent DDT in kerosene applied in December was 100 per cent lethal on termites in mango groves

Effect of Synthetic Pesticides on Stored Grains Field Crops, etc.

Toxicology and adverse effects of synthetic pesticides were studied at the Indian Agricultural Research Institute, New Delhi and at the Agricultural College and Research Institute, Coimbatore. At the former, persistence of insecticides on stored grains as well as on field crops was studied. In wheat grain treated with 10 per cent DDT as dust at the rate of two ounces and four ounces per 125 pounds of grain and stored in glass jars, the residual content remained almost the same throughout the storage period of six months. When the grains were winnowed and washed, DDT was in the range of 3.24 to 5.96 p.p.m. in the lower dose and 6.3 to 7.92 p.p.m. in the higher dose.

Jute bags containing wheat were dusted externally with 10 per cent DDT dust at the rate of six ounces per 100 square feet. Grains lying close to the packing material were contaminated up to an extent of 3.6 to 8.1 p.p.m. in about a week.

Maize crop was sprayed twice with 0.1 per cent DDT and 0.1 per cent BHC emulsion to control *Chilo zonellus* till it reached the fodder stage. Fodder samples showed 0.11 to 0.02 p.p.m. DDT and 3.75 to 6.25 p.p.m. BHC immediately after the second spray. When the sample was taken 12 days after the second spray, DDT residue ranged from 0.22 to 0.56 p.p.m. and BHC from 0.6 to 1.25 p.p.m.

Another application of the treatment was made at the small cob stage and samples of cob husk and grains were analysed for the insecticides 20 days after the spray. The cob husk sample showed 0.31 to 0.45 p.p.m of DDT and 0.5 to 0.75 p.p.m. of BHC. There was no trace of either DDT or BHC on the grains.

Mustard crop was dusted with 5 per cent DDT and 5 per cent BHC against *Phyllotreta* beetles at the 'sag' stage. After two days the leaves showed 5.40 to 8.64 p.p.m. DDT and 3.6 to 6.0 p.p.m. BHC, and after one week it ranged from 4.9 to 5.8 p.p.m. and 1.8 to 2.3 p.p.m. of DDT and BHC, respectively.

Cabbage plants were adjusted and sprayed with 2.5 per cent DDT and 5 per cent BHC dusts and 0.2 per cent DDT and 0.1 per cent BHC emulsion three times against *Pieris brassicae, Plutella maculipennis,* aphids, etc. The cover and inner leaves were analysed one immediately after the third application and again after one week. In the first analysis it showed 1.3 to 2.7 p.p.m. and 2.3 to 3.2 p.p.m. DDT on the cover and inner leaves, respectively. BHC dust residues ranged from 3.7 to 5.8 p.p.m. and 3.0 to 4.2 p.p.m. DDT on the cover and inner leaves, respectively. Sprays left more residues and DDT was 20.0 to 31.2 p.p.m. on the cover leaves and 15.6 to 17.2 p.p.m. on the inner leaves. BHC residues were 6.7 to 17.8 p.p.m on cover and 1.9 to 3.4 p.p.m. on inner leaves. Similar analysis was done after one week from the previous treatment. Similar treatments were given to tomatoes and the residues were determined without and after washing.

At Coimbatore, three systematic insecticides: metasystox, systox and pestox, were tried as foliar sprays against *Chilo zonellus* in *cholam* (*sorghum*). The treatment neither reduced the stem borer infestation nor increased the yield. However, when applied against mealy bugs on cotton only systox proved very effective in controlling this coccid, the residual toxicity lasting for four weeks. On horsegram, blackgram, greengram and cowpea at 0.05 per cent, 0.1 per cent and 0.2 per cent concentrations there was no phytocidal action on the plants even during frequent spraying and when concentration was raised.

Cashewnuts

In Madras, experiments on control measures (on cashewnut pests) revealed that cashew borer could be checked by a spray of 0.1 per cent BHC. The use of 0.05 per cent BHC or 0.025 per cent parathion kept the leafminer under check. Tea mosquito-bug was controlled by 0.1 per cent DDT.

Nutritional and Biological Studies on Insects (I.A.R.I.)

Insect-host relationships were studied in *Lasioderma serricorne, Sitotragoa cerealella, Chilo zonellus and Tribolium castansum*

Vitamins like B-Complex and certain amino acids were found to influence the growth and reproductive potential of insects. *Trogoderma granarium,* a serious pest of stored grains, could develop with very low concentrations of nicotinic acid, choline chloride and thiamine. An all-amino diet was developed for this insect.

In case of *Latheticus oryzae,* different insect stages responded differently on different grains or even on same commodity given in different physical condition. A suitable formula for diet in which gluten formed the protein source was determined.

Farias spp., a cotton pest and *Dacus,* a fruit fly, were successfully bred from egg to adult stage in the laboratory.

Nutritional studies on primary borers formed basis of suitable techniques for developing immature stages on semi-natural and chemically defined diets. Such techniques were evolved for rearing *Litophilus* and *Callosobruchas.*

Beetles, *Oryzaephilus surinamensis* and *Rhizopertha dominica,* were found to harbour some becteria like micro-organisms in their fat bodies, which appeared to influence the physiology of some vital process in insect metabolism. These symbiotic microbes were successfully cultured on artificial medium at the Indian Agricultural Research Institute, New Delhi.

Physiological Relationships between Insect Pests and their Host Plants (Delhi University)

Oxycarenus loetus, a pest of cotton, and ***Bagrada picta,*** a pest on some cruciferous plants, were under study. *Bagrada picta* preferred to feed on infloresences and the fruits of the host plants. *Oxycarenus leotus* preferred the green stem and leaf portions of the cotton plant for feeding and nestled among its drier portion. It derived nutrients from the phloem tissue of the leaf. The passage of food in the alimentary canal was studied. The hydrogen-ion concentration in the various regions of the digestive tract seemed to be uniform and the pH values ranged from 5.2 to 6.0. Micro-techniques to estimate the enzymatic activity of a single insect by means of chromatography and electrophoresis, and the distribution of enzymes in the different regions of the gut of *Oxycarenus loetus* were evolved.

Oxycarenus hyalinipennis was found to infest only cotton and other malvaceous plants. Nymphs and adults preferred leaves and opened cotton bolls. They drew sap mainly from the mesophyll and phloem tissues of the leaf and from the seed hull. The insect was guided to opened cotton bolls by thigmotaxis and phototaxis. It was guided towards green parts like leaf, epicalyx and green bolls, by means of hydrotaxis and phototaxis.

Saccharo-trophism was responsible for its feeding activities. The pH values in the digestive tract varied from 5.2 to 6.4.

Hairy Caterpillar (Eupterotes canaraica) *on Cardamom*

The incidence of this pest was on the decline in the districts of Coorg, Hassan and Chickmagalur. Its life-cycle was studied in the laboratory at Kudige. A detailed pamphlet in Kanarese on its control was distributed.

Systematic and Biological Studies on Rats (Delhi University)

Rats in Delhi are represented by four genera: *Rattus rattus, Mus dubius, Nesokia indica* and *Meriones hurrianae*. The first two prefer dwellings and the other fields. The depth of burrows varied from 2 to 14 inches and their diameter from 2 to 8 inches.

Breeding season of field rats coincided with the ripening of crops. Maximum pitch of pregnancy reached in November in the case of house rats and February-March in field rats (*Nesokia indica*). The number of embryos per rat varied according to the season and environment. The size of litter was comparatively smaller in field rats. Female house rats came to maturity in six and seven weeks, whereas the male rat attained maturity in seven to eight weeks. Field rat, *Nesokia indica*, matured one week eariler than the house rats.

Harmful Birds

A survey of birds visiting crops like *jowar, bajra, nilwa*, guava, fig, etc., was undertaken in the districts of Poona. East and West Khandesh and Nasik. Their stomach-contents were examined and they were grouped as useful, harmful and semi-harmful (those feeding on crops and insects) birds. An automatic sound producing machine, the protocrop machine, was tried to drive them away. In order to scare them away distress calls of parrots were tape-recorded in the first instance.

Plant Virus Research Scheme for Eastern Zone, Indian Agricultural Research Institute in West Bengal and Tripura

During the survey, the following diseases showing virus-like symptoms were noted:

Mulberry (*Morus indica*) : yellow vein mosaic.

Mulberry var. China White Fruit: yellowing.

Ginger (*Zingiber officinala*): *Chirke* disease.

Tea (*Camellia thea*): yellowing, chlorosis, stunting, sterility, mosaic.

Orange (*Citrus sinensis*): decline.

Mango (*Mangifera indica*): malformation.

The *Chirke* disease of ginger was found to be transmitted through infected rhizomes. The *Chirke* disease of large cardamom (*Amomum subulatum*) was transmitted by sap inoculation and its virus nature was established. Further it was found that virus infected arrowroot and wheat.

Foorki Disease of Cardamom

In order to check the spread of this virus disease among the cardamom plantations in West Bengal, eradication of affected plants and spraying of the plantations with aphicide were carried out in the different centres. Eradication and destruction of Foorki-affected plants was done by injecting Agroxone-3. Destruction of the insect vector (*Pentalonia nignonervosa*) was done by spraying Folidol E 605 (0.04 per cent concentration) at the basal region of the plants during the period November-April. The plants flowered from April

when the treatment was discontinued. This scheme was successfully adopted at the Pukriabong, Kashyong, Sakyong, Pakyond and Lamagaon centres. Healthy substitute seedlings were distributed to the cultivators for planting.

Effect of hot-water treatment in killing the virus of Foorki in the affected rhizome was studied, but the treatment at 50°C for 10 minutes did not show any beneficial results.

'Kattee roga' or the Mosaic Disease of Cardamom

Studies of the mosaic disease and the methods of control were made at Saklespur, Mudigere and Sirsi in Mysore State. Survey of diseased plants was done in several cardamom estates. As a measure of control, the affected plants were destroyed and disease-free substitute seedlings were planted.

Wilt Disease of Jeera (Cuminum cyminum)

The causal organism responsible for the disease was found to be *Fusarium oxysporum* and *F. cumini*. Inoculation experiments showed that infection was the greatest when the soil was mixed with the inoculum. When plants of different ages were inoculated, two to three-week old seedlings showed the maximum infection. Different isolates of the fungus showed varying degrees of pathogenicity. Sandy soil was found to be more favourable for the development of the disease than a clay one. Early sowing of the crop in November reduced the incidence of the disease. No resistant strains of *jeera* (against the fungus) could be isolated. The maximum incidence of wilt was noticed during January-February.

Survey of the Fungal, Bacterial and Virus Diseases of Chillies, I.A.R.I., New Delhi

In addition to mosaic, leaf curl, bacterial leaf spot, die-back, wilt and *Colletotrichum* fruit rot, two new diseases, namely, seedling damping-off and *Alternaria* fruitrot were observed on chillies.

Varieties Puri Red, Puri Orange, Cuttack Red Erect, R. S. 8, Kandiveram and cross Puri Red × NP 46A were resistant to the mosaic virus. The variety Bombay 469 was found to be a symptomless carrier of the virus. In host range studies, *Solanum nodiflorum* alone, out of ten species, proved to be a smymptomless carrier; in none of the others was infection observed. Life-cycle of the different causal organisms of important fungal and bacterial diseases were studied Bacterial leaf spot (*Xanthomonas* vesicatoria) was found to infect *Solanum modiflorum and Solanum nigrum* in addition to chillies and tomatoes. Varieties Kandiveram, Patna, Bombay 469, Suryamukh Red Erect and I.C. 3526 were found to be resistant. Two races of *Colletotrichum* sp. causing fruit rot were established, having different morphological characters and degree of virulence. A *Pythium sp.* was found to cause damping-off of seedlings.

Control of Bundha *Parasite*

Bundha parasite (*Dendraphthoe falcata*) was recorded on 158 hosts including several fruit trees at Saharanpur. Two other parasitic plants (*Swrrula cordifolia* and *S. pulverulenta*) were also noted

to infect some of the important commercial fruits like plum, peach, pear, mulberry and pomegranate. 0.75 per cent of 2, 4-D sprays killed all the parasites. Sodium salt of 2, 4-D and Fernoxone also produced similar effects. T.C.A. 5 per cent ammonium thiocynate and ammonium sulphamate sprays effected both the parasites and the host plants.

AGRONOMY AND SOIL SCIENCE

Investigation of Fundamental and Applied Aspects of Soil Science, I.C.A.R., Various Universities and State Research Stations

Usar lands reclamation studies were undertaken at the Lucknow University. Investigations on synthetic poly-electrolytes as soil conditioners for the improvement of soil structure were in operation at the Indian Association for the Cultivation of Science, Calcutta. Research on humification of organic matter at the Agra College showed that the mineralised nitrogen content in the *dumat* soil of Agra district could be increased by the humification of local weeds and plants, irrespective of their being leguminous or non-leguminous. Investigations on survey of the micro-flora of soils in relation to their structure and the role of earthworms in the micro-flora of soils at the Fermentation Technology Laboratory, Indian Institute of Science, Bangalore, showed that appreciably earthworms did influence either the number or the types of some of the physiological groups of soil-organisms. Likewise, research on *Azotobactor* inoculation of crops at the State Agricultural Research Institute at Tollygunj and at Presidency College, Calcutta, in West Bengal, brought forth interesting information on some of the useful bacteria.

Crop Weather and Phenological Schemes, Central Meteorological Observatory, Poona

Climatic influence on crop production and other aspects of agronomy under investigation through various projects, included investigations on Farm Practices, Model Agronomic Experiments, Simple Fertiliser Trials on Cultivators' Fields, Green Manuring and Weed Control.

Investigation on Farm Practices: In October, 1957, the Council started a scheme with the main objective of preparing an authoritative inventory of agronomic practices of the major crops, with particular reference to different soils and climatic regions of the whole country. A detailed information on the farming practices in different States and in varying soil-crop regions of India is lacking at the moment; consequently, it is not feasible to recommend good practices prevalent in one region to other regions, with similar soil-climatic-crop conditions. Under the present scheme, surveys would be conducted by special staff appointed by the respective State Governments with the funds placed at their disposal by the Council. The technical control of the scheme rests with the Council and surveys will be conducted in close collaboration with the State Departments of Agriculture.

The country was divided into six regions for this purpose: (i) Punjab (including Delhi), Jammu & Kashmir, Himachal Pradesh, and Rajasthan; (ii) Uttar Pradesh and Bihar; (iii) Bombay; (iv) Assam, West Bengal, Tripura, Manipur and Orissa; (v) Mysore, Kerala and Madras; (vi) Madhya Pradesh and Andhra Pradesh. Each

region was proposed to be sub-divided into a suitable number of zones and one agricultural assistant [B.Sc. (Agriculture) with some experience], would be placed in charge of each zone. He would work under a Senior officer of the State Department of Agriculture nominated by the Director of Agriculture of each state. There would be 40 zones in all and for convenience of the survey each zone would be further sub-divided into three or four zones with homogeneous agricultural conditions. The sub-zones would form the primary unit of survey. The factual data, as locally available from progressive cultivators, average group cultivators and agricultural farms is proposed to be recorded in a systematic manner in the proformas specially designed for the purpose. It was proposed to take up two regions per year so as to complete the survey within the sanctioned period of three years. During the period under report, greater part of the time was spent in organising the scheme, recruitment of the staff, preparation and printing of proformas and negotiations with the States of region I and II to start the scheme. So far the scheme has started functioning in region I and will be followed up in region II, Uttar Pradesh and Bihar next.

Model Agronomic Experiment Scheme : The primary objective of this experimentation is to investigate the optimum depth and delta of irrigation in relation to doses of nitrogen and phosphate for various field crops, to determine manurial requirements for various crop rotations commonly grown in different parts of the country, and to find the suitable method and optimum time of application of fertilisers for major crops.

With these objectives in view, complex manurial, cultural, rotational and irrigational experiments are being conducted at 33 centres located in various agro-climatc regions of the country. At each centre eight complex factorial experiments are being conducted During *kharif* 1958, 79 experiments were conducted on paddy, cotton, *jowar,* maize, groundnut and *kharif* legumes. During *rabi* 1958-59, about 90 experiments were conducted on such important field crops as second corp of paddy, wheat, sugarcane, gram and *rabi jowar.*

The results of experiments were statistically analysed and found satisfactory. The average response to nitrogen in the form of ammonium sulphate was 4.2 maunds of paddy per acre for 30 pounds nitrogen. Such a response was significant at all the centres except Karamana (Kerala State). As nitrogenous fertiliser, ammonium sulphate and urea, proved equally effective. Application of phosphate proved less beneficial compared to nitrogenous fertiliser. The average response to 30 pound P_2O_5 per acre was 2.0 maunds of paddy. Application of 30 pounds of N plus 30 pound of P_2O_5 per acre increased paddy yield by 5.5 maunds per acre. Three sources of phosphatic fertiliser, namely, superphosphate, ammonium phosphate and dicalcium phosphate proved equally effective as carriers of phosphorus. Of the three methods of application of phosphatic fertilisers, pellet-application gave significantly higher responses than broadcasting at puddling or broadcast-application in mud slush.

Application of 20 and 40 pounds nitrogen per acre in the form of $1\frac{1}{4}$ and $2\frac{1}{2}$ maunds of ammonium sulphate increased *jowar* yield by 3.3 and 7.4 maunds per acre, respectively. The responses were

higher at Gangavati centre (Mysore State). The various nitrogenous fertilisers: ammonium sulphate, ammonium nitrate and urea, proved equally effective. Placement of phosphatic fertiliser proved effective in increasing *jowar* yield.

Co-ordinated scheme of simple fertiliser trials on cultivators' fields. The scheme was initiated to study responses to doses of nitrogen, phosphate and potash on cultivators' fields for working out a manurial schedule for different field crops under various agro-climatic regions of the country. Trials were conducted to determine relative value of various nitrogenous fertilisers—ammonium sulphate, urea, ammonium sulphate, nitrate and calcium ammonium nitrate and other nitrogenous fertilisers—which are likely to be manufactured in the country. This will enable us to recommend to the cultivators the right type of fertiliser for different crops.

The relative crop-producing value of different phosphatic fertilisers was also under study and three types of simple fertiliser trials were conducted on cultivators' fields in the irrigated or assured rainfall areas (35 inches and above) of the country.

During the year 1958-59, the scheme was sanctioned for 15 States, namely, Assam, Andhra Pradesh, Bihar, Bombay, Delhi, Himachal Pradesh, Kerala, Madhya Pradesh, Mysore, Madras, Orissa, Rajasthan, Punjab, Uttar Pradesh and West Bengal. So far experiments have been conducted in 12 States. In the remaining three States—Bombay, Madras and Assam—arrangements were made to appoint the field staff to carry out the programme during *kharif* 1959. During *kharif* and *rabi* 1957-58, 843 simple trials were conducted on paddy, wheat, *jowar*, groundnut, sugarcane, potatoes and cotton. The results of these experiments were received for statistical analysis.

Supervisors and field assistants appointed in various states are given field training for a week by the Agronomist, Indian Agricultural Research Institute, Statistician, Indian Central Agricultural Research and the Assistant Soil Chemist of T.C.M. soil testing centre in collaboration with the State Agricultural Chemist, Agronomist and Statistician. So far the training of the field staff has been completed for Himachal Pradesh, Rajasthan, Bihar, Orissa. Mysore, Kerala, Punjab, Uttar Pradesh and Andhra Pradesh.

During *rabi* 1958-59, the simple trials were conducted in 74 districts of the country. The state-wise distribution of these experiments is: Delhi-1, Rajasthan-4, Punjab-11, Mysore-7, Bihar-11, Andhra Pradesh-10, Uttar Pradesh-10 and West Bengal-14. Thus the 37 supervisors and 296 field assistants have conducted nearly 4,500 trials during the season. The crops covered by these trials were the second crop of paddy, wheat, gram, linseed, sugarcane, potatoes, chillies and *rabi jowar*.

Weed Control. Co-ordinated weed research schemes were in operation at the National Chemical Laboratories, Poona from 1953-57, for the local manufacture of pure weedicides; and in the Bose Institute, Calcutta, from 1953-58 and at Coimbatore from 1952-56, for evolving proper weedicidal schedules. These schemes were completed and a new set of co-ordinated schemes on a model pattern was

set in operation in Assam at Jorhat (since 1957), Bombay at Nagpur (since 1955), Madhya Pradesh at Bhopal (since 1955), Himachal Pradesh at Chhabra (since 1954), and the Punjab at Ludhiana (since 1957). Useful information on the eradication and control of weeds of the regions is now available and would be utilized to tackle the menace of weeds in agriculture.

Green manuring: Co-ordinated investigations on a uniform pattern and on various aspects of green manuring are being promoted by the Council and were in operation in Andhra Pradesh and Bihar since 1955, Bombay since 1956, Himachal Pradesh, Mysore, Barackpore (West Bengal), and Cuttack since 1954, 1955, 1957 and 1953, respectively. Interesting and useful information on suitable techniques of green manuring with various plants and also on various crops such as rice, wheat, jute has been gained from this chain of schemes.

Fertiliser demonstration on cultivator's fields: The scheme of fertiliser demonstrations on cultivators' fields was continued during the year 1958-59. A total of 3,713 tons of different fertilisers were allocated to the states for demonstrations on cultivators' fields. The need for application of potash fertilisers has been realised in recent years. Therefore, NPK fertiliser-mixtures containing varying amounts of Potash were demonstrated. The scheme has not paved the way for higher consumption of fertilisers in the country. The new fertilisers, *i.e.*, urea, ASN and CAN, require extensive publicity to make them popular.

TUBER CROPS

Potato

In the Punjab, "Aldrin" emulsion at 1 to 1½ pound active ingredient per acre proved to be the most effective and economical treatment for suppressing the incidence of cutworms. For potato tuber moth, sweet flat (*Acorus ealamus*) root dust at 6 onces per maund proved to be the best treatment, followed by BHC, DDT and other treatments.

Tapioca

In Kerala, Hybrid 450/52 gave better yield and was multiplied for distribution.

In varietal trials under Coimbatore (Madras State) conditions, type *Malavella* proved to be superior yielding 20,005 pounds per acre.

Under Mangalore (Mysore) conditions, variety *Nachikoothan* produced highest yield with 13,875 pounds per acre followed by *Neelam* with 13,391 pounds.

In cultural experiments in Kerala planting on ridges gave better yield than mound planting. Optimum spacing for short, and sparse-branching types was found to be two feet both ways whereas for profuse-branching types best results were obtained at a spacing of 3 feet both ways.

In Kerala, increased dosage of potash and nitrogen with insignificant effect of phosphorus caused distinct differences in yield.

Sweet potato

In the Punjab, out of varietal selections, type V_2 (F A 17 White), V_6 (FA 17 Red) and V_8 (American FB 4004) proved superior to the local varieties. Specing trials showed that one foot from plant to plant and one foot from row to row gave best results. At Sabour (Bihar), cross four significantly outyielded V_{35} V_{15} and V_{10}. In varietal trials at Coimbatore maximum yield was obtained from crop planted at three feet spacing between the rows and six inches in the row. The exotic types V_2 V_8 and V_{12} along with B219 proved superior yields.

Varietal trials at Mangalore (Mysore State) have shown superiority of IB22 and V_{12} varieties which recorded maximum yields of 10,285 pounds and 14,617 pounds per acre, respectively. A spacing of two inches between rows and six inches between plants was determined to be the optimum for the second crop season.

In the Punjab, it was found that early plantings from May to middle of June under irrigation proved to be superior to later sowings.

Combined trials conducted at Madras and Kerala on the different times of planting and different frequencies of irrigation showed that irrigating the crop at intervals of four days was profitable and early planting in November gave the maximum yield (21,209 pounds per acre).

In the disturbed *versus* undisturbed vine trials carried out at Mangalore, disturbance of vines at frequent intervals detracted from the yields. Likewise unpruned vines gave higher yields as compared to pruned vines. Experiments in the Punjab gave adverse effects with any type of pruning.

Experiments on manurial trials in the Punjab showed that a dose of fifty pounds N as ammonium sulphate, *i.e.*, three maunds ammonium sulphate per acre was the most economical. Similar trials at Coimbatore (Madras State) indicated that either green manure or farmyard manure were enough for better yields without any addition of N as compared to no treatment. Manurial experiments at Mangalore (Mysore State) showed that ammonium sulphate was a better form of supplying N than sodium nitrate under Mysore conditions. Furthermore, superphosphate proved to be better than bone-meal for the supply of phosphoric acid.

Colocasia

In varietal tests in the Punjab S-11 yielded 465 maunds of tubers per acre followed by S-3 with 454 maunds per acre. In spacing trials, a planting distance between rows of one and a half feet and between plants of twelve inches was seen to be the best.

Manurial trials in the Punjab showed that 100 pounds N as ammonium sulphate, *i.e.*, six maunds of ammonium sulphate per acre was the most economical dose.

Alti (Alcasia indica)

In the manurial trials at Sabour (Bihar), N applied at the rate of 60 pounds per acre significantly increased the tuber yield.

Spacing trials showed that 6 inches × 9 inches spacing was superior to 12 inches plant spacing in respect of yield.

VEGETABLES

Cauliflower

Observations on cauliflower selections at Krishnagar, West Bengal, indicated that *dania*, a mid-season variety, was superior in all respects. Experiments on the optimum time of planting at the same station showed that early November (3-11-57) planting was superior. At Kalimpong, West Bengal, early and late October were found desirable in respect to time of planting.

Cabbage

In varietal trials carried out at Krishnagar, West Bengal, Pride of India, gave desirable yield. At the Kalimpong centre, Eclipse Drumhead and Perfection were promising. Experiments on optimum time of planting showed that the second week of November (9-11-57) was the best for the purpose while at Kalimpong early and late October were found to be better than other periods.

Radish

In varietal trials in Madras State, five types—*H*.288, *H*.201, *H*.115, *H*.313 and *H*.289, were promising. Similar trials at Krishnagar, West Bengal showed that Red White tipped type was superior.

Carrot

Varietal trials carried out in Himachal Pradesh showed that the varieties Early Nantes and Tender Sweet were superior in quality.

Turnip

In Himachal Pradesh, P. T. White Globe was observed to be a variety with wider adaptability than the others under trial.

Peas

Observations at Krishnagar, West Bengal, showed that Early Giant among early peas and Telephone among the mid-season varieties were superior. At the Kalimpong centre, Telegraph and Alderman were promising. In Himachal Pradesh, N.P. 29 gave better yield.

French Beans

Experiments at Hyderabad, Andhra Pradesh on spacing and varietal trials showed that, Canadian Red was better than Asgrow Stringless and Bountiful types and drilling with a spacing of one foot was better than the spacing of 2 feet × 2 feet.

Onions

Varietal trials in the Punjab showed that types *B*.26, *B*.33, *B*.45, *B*.36 and *B*.38 were promising. In Andhra Pradesh, similar trials indicated that Bellary Big is a superior yielder producing 17.116 pounds of bulbs per acre.

In spacing trials in Andhra Pradesh, a spacing of 3 inches × 4 inches proved distinctly better to 5 inches × 8 inches.

Results of the varietal-cum-sowing date trials in the Punjab showed that early planting provided higher yields than the sowing following it. Type 32 gave the highest yield. In four varietal trials conducted at Departmental farms, namely Gurdaspur, Karnal, Beas and Bhunga, type *B*.26 gave the highest mean yield registering an increase of 87.6 per cent over the local.

Garlic

In varietal trials with 12 types in the Punjab, Selection Nos. 50.1, 24.2 and 61.4 gave higher yields than the local. In a varietal-cum-sowing date trial, Selection 15.10 gave significantly higher yield than the other types. Late sowing (25th September, 5th October and 15th October) resulted in higher yield than when the crop was sown on 15th September. In West Bengal, spacing trials showed that the spacings 9 inches × 3 inches and 6 inches × 3 inches led to higher yields.

Chillies

Out of 134 collections tested at Karnal farm, Punjab, 80 single plant selections on the basis of yield and freedom from virus were made. Type No. 348 was found to be the most promising.

In the bulk yield trials in Andhra Pradesh, G. 2 was the highest yielder. The Yellow-anther mutant (C.A. 825) isolated from G. 2 compared favourably with G. 2.

Trials of hybrid lines in Andhra Pradesh indicated that four hybrid progenies, *viz*., X91-6-3, X91-6-5, X94-1-1 and X116-2-2 were superior yielders as compared to G. 2 and held promise for cultivation in irrigated areas. In small bulk trials and corresponding family block trials, hybrid culture X33 d-1-1-1-2 appeared promising for irrigated areas. Culture CA 452-1 was superior to G. 2 in district trials and could replace it in the rain-fed areas.

Survey of diseases at the Indian Agricultural Research Institute New Delhi, indicated the presence of mosaic, leaf curl, bacterial leaf spot, die-back, wilt and *Colletotrichum* fruit rot. In addition, two new diseases, *viz*. chilli seedling damping-off and *Alternaria* fruit rot were also observed.

In trials carried out at the Indian Agricultural Research Institute, New Delhi, Puri Red, Puri Orange, Cuttack Red Erect, Kandiveram R.S. 8 and the Cross (Puri Red × NP46A) were found to be disease resistant. Variety Bombay 469 observed to be a symptomless

carrier of virus. Host range studies on the chilli mosaic virus indicated that only *Solanum modiflorum* was a symptomless carrier of the virus.

Studies carried out at the Indian Agricultural Research Institute, New Delhi, on the host range of the causal organism showed that the pathogen infected *Solanum modiflorum* and *S. nigrum* in addition to chillies and tomatoes. Varietal test showed that Kandiveram, Patna, Bombay 469, Suryamukh Red Erect and I.C.3526 were resistant.

Tomato

In Madras State variety *H.* 261 recorded the highest yield of 18,621 pounds per acre. In similar tests at Krishnagar, West Bengal, Prosperity and Hybrid four proved to be superior. At the Kalimpong centre Sioux was promising. In Uttar Pradesh, plants of a cross between Kalianpur Type 1 and Early Chatham were found to have some desirable characters. In varietal trials, Rutgers gave the highest yield. At Bhaulakauan, Himachal Pradesh, Hybrids 10, 11 and 12 gave significantly higher yields.

Experiments on the optimum time of planting at Krishnagar, West Bengal, showed that late September (25-9-57) and second week of October (10-10-57) were superior, while at the Kalimpong centre late September and early October proved to be the best periods.

Brinjal

In Madras State, Type *H.*291 (Aushey) gave the highest yield of 9,888 pound per acre. The selection from I.C. 1855 recorded highest yield of 24,140 pounds per acre in the summer season of 1956. S.M. 6 recorded 20,836 pound per acre in bulk yield trial and was found to be superior to the rest.

In observational trials at Krishnagar, West Bengal, selection 53 was found to be superior.

In Uttar Pradesh, hybrid vigour was manifested in all the crosses between T.1, T.2, 5137-4-1-2-1 (long-fruited) and T.3, T.4 and Black Beauty (round-fruited). In varietal trials, 910-5-1-1-1 and 5145-1-1-1-1 were the outstanding yielders.

In a factorial experiment on spacing and varieties and row testting at Hyderabad, varieties Long Purple, Long Cluster and Green Long Cluster were found to be better than the local.

Experiments on the optimum time of planting at Krishnagar showed that late September (30-9-57) and October (15-10-57) were superior.

Experiments at Madras showed that spraying Dieldrin 0.1 per cent (W.P. 50 per cent one ounce in three gallons of water) brought down the shoot borer incidence to nil.

Among the insecticidal treatments tried against the shoot and fruit boring caterpillar in Andhra Pradesh, Endrin 0.042 per cent in shoots and fruits reduced infestation to 1:7 per cent and 32.3 per

cent respectively, and was superior as compared to other treatments. Infestation was wholly warded off with Endrin at 0.062 per cent and 0.042 per cent concentrations.

In the Punjab, experiments on the control of brinjal fruit and shoot borer *Leucinodes orbonalis* with different insecticides showed that five sprays with Endrin 0.04 per cent at 10 to 15 days intervals were the most effective and cheapest. Endrin, Parathion and Diazinon emulsions at 0.04 per cent proved equally effective against other pests of brinjal like mite, jassid and aphids.

Experiments in Andhra Pradesh on controlling the lace wing bug, *Urentius echinus* with different insecticides proved effective when endrin 0.006 per cent, 0.012 per cent diazinon 0.006 per cent 0.012 per cent and malathian 0.015 per cent and 0.031 per cent were used.

In Andhra Pradesh, complete control of the mealy bug, *Phenacoccus insolitus* was obtained after 24 hours of treatment with 0.078 per cent Malathion. HETP 0.2 per cent and Diazinon 0.042 per cent gave complete control after 48 hours.

Bhendi (Lady's finger)

In Madras State, Type 149 recorded the highest yield of 3,886 pounds per acre. Varietal trials in Rewa, Madhya Pradesh, showed that types Sabour Selection and Long Green were superior.

Spacing and varietal trials in Hyderabad indicated that Shankerpalli and Red Wonder were better than Rajasthan variety. The spacing 2 inches × 1 inch was found to be better than 2 inches × 2 inches.

Effective control against *Earias sp.*, the shoot borer was obtained in Andhra Pradesh when Endrin in 0.042 per cent, 0.032 per cent and 0.021 per cent concentration was used. Complete kill of green leaf hopper of *bhendi, Empoasca Elavescens* Fb. was noticed after 24 hours when Endrin 0.042 per cent, Diazinon 0.031 per cent and Malathion 0.078 per cent were used.

In the Punjab, control of spotted bollworm *Earias insulana* was obtained when Endrin 0.04 per cent was used as a cover spray at 100 gallons per acre between the periods July 17 and September 30 at 10 and 20 days intervals. Next best treatment was Diazinon emulsion 0.04 per cent.

Gourds

Types H. 8 and H. 21 of snake gourd; H. 279 and H. 7 of bitter gourd and H. 160 of ribbed gourd gave promising results in Madras State. The better and ribbed gourd giving a yield per acre of 3956 pounds, 3360 pounds and 5998 pounds respectively.

In Andhra Pradesh, infestation of the fruit fly *Dacus cucurbitae* Coq. was controlled with Diazinon 0.042 per cent and 0.031 per cent. Endrin 0.042 per cent and 0.031 per cent, and Malathion 0.078 per cent.

Of red gourd varieties, Large Red proved superior in Rewa, Madhya Pradesh.

Experiments in Madras State showed that Bordeaux mixture at 10 per cent proved to be the best for control of downy mildew.

In Madras State, varietal trials in three types of ash gourd, *H.*57, *H.*105, and *H.*162 and four types of pumpkins, *H.*58, *H.*343, *H.*104 and *H.*59 were promising.

Melons

Sixteen exotic and 11 indigenous new collections of water-melon were added this year at the Delhi centre bringing the total of exotic to 44 and indigenous to 14.

At the Cuddapah centre, Andhra Pradesh, types E. C. 10078 (O tome-Japan), E.C. 10081 (Nagacha Kohai miyake Shinke-Japan) and Shin Yamato (Japan) were found promising.

Varietal observations at Kalianpur Centre, Uttar Pradesh, showed that Asahi Yamato, Ice Box, E.C. 7928, *Fukin mudirigo* were most promising as regards sweetness and other agro-economic characters.

One hundred and ninety-one new indigenous and 10 new exotic types of musk-melons were added bringing the total of indigenous to 224 and exotic types to 23 at the Delhi centre.

Varieties found most promising at the Cuddapah centre, Andhra Pradesh were: *Salam, Sharbat,* I.C. 4981, *Bathasa,* and *Shirangir.*

FRUITS

Mango

Marked root promoting effect of I.B.A. and N.A.A. on mango layering was observed at Calcutta University, West Bengal.

In manuring trials conducted by the Department of Agriculture, Bombay State, preliminary indications showed that N either alone or in combination with P had a beneficial effect. In hybridization, 46 inflorescences involving nine combinations were selfed and 1,884 flowers were cross-pollinated. Successful combination of Alphonso × *Neelum, Alphonso* × *Dadomio, Alphonso* × *Totapuri* and *Vanaraj* × *Jamadar* were secured . At the Horticultural Research Institute, Saharanpur, Uttar Pradesh, the crosses made between *Totapuri Red* small × *langra. Dusehri* × *Totapuri* Hyderabad and *Dusehri* × *Romani* were under study. At Hyderabad up till now 231 promising varieties were collected and 31,306 crosses made and 90 hybrid fruits were obtained which are under study.

Trials to determine the effect of blossom thinning on the biennial bearing habit of three varities *viz., Fajri Zafrani, Fazri White* and *Samar Bahisht Chausa,* at the Government Horticultural Research Institute, Saharanpur, Uttar Pradesh, were continued, after removal of 50 per cent of total blossoms in the full 'on' year. *S.B. Chausa* attained both maximum of scion girth and volume of tree. At Hyderabad, studies on blossom biology of 29 varieties were made.

At the Government Fruit Research Station, Kodur, Andhra Pradesh, a maximum fruit set of 37.11 per cent was recorded in the treatment with X-naphthalene acetic acid (5 p.p.m.) in bud stage in variety *Neelum* and 80.58 per cent in *P*-naphthoxy acetic acid (5 p.p.m.) and 84.94 per cent in I.A.A. (15 p.p.m.) in bud and flower stages, respectively in Bangalore variety.

At the Central Food Technological Research Institute, Mysore, treatments with sodium-ortho-phenyl-phenate resulted in reducing the wastage percentage in *Alphonso* mangoes stored at room temperatures (70°-86°F.) and 47°-50°F.

The monograph on mango varieties of India, entitled "The Mango" was released by the Indian Council of Agricultural Research.

Banana

At the Ganeshkind Fruit Research Station, Poona, 28 table varieties and four cooking varieties were added to the collection. Seventeen varieties resistant to mosaic disease were selected. At the Central Banana Research Station, Aduthurai, 77 hybrids in 14 parental combinations were under study. A selection in *poovan* for its semi-tall stature was also under study.

Observations made on the selection of planting material showed that the selection of the planting material should be made at the time of flowering or within a month after flowering.

It was found that whole rhizomes in pits flowered earlier. One pound rhizomes gave significantly superior yield, but flowered late. February planting gave better results than April and June plantings. Trials on ripening of banana (*basrai*) showed that with 2, 4-D at 300 and 600 p.p.m. the ripening of fruit took place two days earlier. The fruit also developed a brighter colour.

At Poona, the pit method of planting gave slightly superior performance over the furrow method. In another trial, rhizomes of *Basrai* weighing one, two and three pounds from primary suckers and one and two pounds from secondary suckers were tested for their growth and yield. One pound rhizones, both from primary and secondary suckers gave significantly superior yield than three pounds ones.

Observations at Chinsurah, West Bengal, on the girth measurements showed that the treatment supplying eight ounces of N, P and K gave significantly higher value than other treatments. At Poona, in manurial experiments on *basrai*, the results confirmed that the crop responded to N alone, and P and K did not give any added advantage under the medium black soil conditions of Poona.

In Kerala it was found that symptoms of the bunchy top disease appeared 35 to 45 days after inoculation of the plants by infective aphids.

Pentalonia nigroverciosa

At Kallar and Burliar Stations, the cross between Red Banana and *Musa coccinea* was sterile. The hybrid seedlings of *puttu vazhai* and *M. balbisia* flowered after 20 months and the fruits showed characters intermediate between the two parents.

Citrus

In propagation trials at the Horticultural Research Station, Krishnagar, West Bengal, 100 per cent success was obtained in Nepali Oblong and 86 per cent in Mayer lemon, by cuttings *kaghzi* lime failed to root, but in sweet lime there was 93 per cent success. In experiments at Calcutta University, 2, 4, 5-T, 2, 4, 5-TP and NB have shown root-promotion effect on citrus cuttings.

At Krishnagar, West Bengal, the last week of January was found to be optimum period for budding in citrus. At the Indian Agricultural Research Institute, New Delhi gibberellic acid (10 p.p.m.) significantly increased the size of *Jullundri khatti* seedlings, indicating the possibility of obtaining buddable plants earlier.

In the root-stock trial at the Horticultural Institute, Saharanpur, *mandarin Srinagar* showed the maximum growth followed by Rangtra and Hill. Among the stocks, Florida rough, Italian 76 and *kharna khatta* proved better. With sweet orange as scion, Vanille showed the maximum growth followed by *mosambi* and Navelencia Among the stocks, *kharna khatta* was the best. At the Government Fruit Research Station, Kodur, Andhra Pradesh, the *sathgudi* buildings on *jamberi,* acid lime on *jamberi* and lemon (var. Nepali oblong) on acid lime registered better growth. In Sathgudi root-stock trials, the trees on acid lime registered large cumulative fruit yields by number and weight. Acid lime buildings on *gajanimma* recorded the highest cumulative fruit yields. The root-stocks *jamberi* and acid lime appeared to be less resistant to dry root-rot than *kichili* and *sathgudi* rootstocks. The combination lemon Nepali Oblong on *gajanimma* appeared to be more resistant to this disease than others.

In similar trials at the Citrus Fruit Research Station, Tharsa (Nagpur), the *santra* trees on *jamberi, jatti khatti* and sweet lime were significantly superior in girth measurements to the trees on other root-stocks. *Santra* budded on Rangpur lime, *Jullundri khatti* and sour orange showed a significantly smaller top growth as compared with other root-stocks. *Jamberi, jatti khatti* and sweet lime induced significantly higher crops than the other root-stocks.

At Genicoppal, Coorg (Mysore State), Coorg orange on *belladakithuli, baduvapulli* and rough lemon was found to be more vigorous than the seedlings, and on sour orange the least vigorous. At the Kallar and Durliar Fruit Research Stations. Madras, *jamberi* in general continued to maintain its superiority as the suitable rootstock for mandarin under local conditions.

The extensive manurial trials at Attari, Punjab, show that the treatments, farmyard manure + ammonium sulphate, ammonium sulphate alone and farmyard manure alone, behaved alike in respect of spread and volume growth in sweet orange block. Treatments, ammonium sulphate alone and farmyard manure + ammonium sulphate were found to be on par with each other as far as yield was concerned, but these treatments were significantly superior over farmyard manure alone and control. Treatment *senji*+ammonium sulphate though at par with *guara* + ammonium sulphate and ammonium sulphate alone in yield, gave better results over *guara* alone, *senji*

and control in this respect. Different treatments failed to show any significant difference in quality of fruit. In the grape fruit block, all the treatments failed to increase vigour, yield or quality of fruits.

Trials conducted at the Citrus Fruit Research Station, Tharsa (Nagpur), indicated that oil-cake gave more vigorous trees than farm-yard manure and the application of N produced more vigorous trees than the trees with no nitrogen.

At the Horticultural Research Station, Krishnagar, West Bengal, fruit-set in sweet orange varieties varied from 50 per cent (Valencia) to 70.7 per cent (Sathgudi) and 4 per cent (Rajahmundhry) to 67.6 per cent (*malta*) in lemons.

At the Fruit Research Station, Kodur, Andhra Pradesh, a 100 per cent fruit-set was obtained with B-naphthoxy acetic acid (15 p.p.m.) in the flower bud stage treatment and with I.A.A. (15 p.p.m.), I.B.A. (10 and 15 p.p.m.), 2-4 D (15 p.p.m.), N.A.A. (5 and 10 p.p.m.) and B-naphthoxy acetic acid (5 p.p.m.) in flower stage treatments as against 54.50 per cent in flower bud and 83.33 per cent in flower stages under control. In *malta* lemon, I.A.A. (5 p.p.m.), I.B.A. (5 p.p.m. and B-naphthoxy acetic acid (15 p.p.m.) in both stages gave cent per cent fruit-set as against 64.70 and 70.00 per cent under control. In Tangarine Dancy, N.A.A. (10 p.p.m.) gave the maximum set.

Micro-nutrient studies. Indian Agricultural Research Institute, New Delhi. Under the co-ordinated scheme for citrus die-back studies, the indications obtained for manganese deficiency showed that the time taken for the appearance of symptoms in seedlings of rough lemon, *baduvapulli*, sweet lime, sour orange and mandarin orange, was influenced by the rates of growth of the shoot and root system. General stunting in growth, pale yellow leaves reduced in size and standing upright were some features observed in rough lemon, sweet lime and *baduvapulli* under zinc deficiency. Chlorosis of terminal leaves starting from tips and margins of the upper half of the lamina and death of the growing tips were the initial symptoms observed due to boron deficiency. Discontinued yellow areas which enlarged and coalesced ultimately resulting in a large area of yellow tissue surrounding triangular area of green tissue around the base of the mid-rib were the magnesium de,ciency symmptoms Chlorosis of terminal leaves starting from tips and margins of lamina followed later by peppering with brown spots and burning were the characteristic symptoms for calcium deficiency. Dullish brownish to green colouration of lower leaves, irregular blotching and dryage of leaves were the symptoms for phosphorus deficiency. Pronounced twisting curling, puckering and yellowing of older leaves, were the symptoms for potassium deficiency.

Under the foliar spray treatments the *malta* tree which did not respond either to iron chelate application in 1955 or to manganese sprays in 1956, at Indian Agricultural Research Institute. New Delhi, responded favourably to Zn sprays. During May 1958, extensive mottling symptoms and acute die-back developed in a large number of trees of *santra* and *malta*. Since the symptoms resembled those associated with Zn deficiency, the plants were sprayed with this

element. In the interaction experiment between P and Mn, Mn deficiency symptoms became more intense in the absence of P.

In the micro-nutrient spray experiment, at Gonicoppal, the spray treatments Zn, Cu, Mg and B treated plants had alower intensity of chlorosis than others.

Taxonomic studies. Under the scheme for the description of important varieties of fruits in India at the Indian Council of Agricultural Research, New Delhi, in all 23 varieties of citrus were described completely and two partially, in respect of vegetative characters ; 48 completely and three partially in respect of floral characters ; and 17 completely and 13 partially in respect of fruit characters. The studies of citrus varieties and hybrids were undertaken for the first time in Assam and at Allahabad, Uttar Pradesh.

In studies on fruit characters, at the Horticultural Research Station, Krishnagar, *malta* and Nepali Oblong lemons and Nafanpal local pummelos were found to be promising.

Studies on citrus die-back at Gonicoppal, Coorg, Mysore State, revealed that nearly 72 per cent of the plants were carrying the symptoms of mottling on interveinal cholorosis. The presence of *Tristeza* virus was suspected on lime based on leaf and twig symptoms. Presence of *Pratylenchus, Aphelenchus* and *Radopholus* spp. of nematodes were noticed and the species of *Pratylenchus* and *Radopholus* were found to be associated with citrus decline.

In a preliminary trial on chemical control of fruit sucking moths, at Kodur, Andhra Pradesh, the fruit drop due to pest attack was least (2.0 per cent) with 0.32 per cent DDT sprays as compared to control. In the case of *citrus* leaf miner, the infection was only 17 per cent as compared to control, when plants were sprayed with 0.04 per cent metasystox.

The results, for preservation of fruits by hormones and chemicals at Gauhati, Assam showed that the application of 60 per cent wax emulsion of Dr. Sharma's germicidal wax to orange extended their overall storage life by 31.0 per cent for the green, 36.0 per cent for the turning and 21.0 per cent for the ripe fruits.

A seedless suspected bud mutant in Foster (Pink) grapefruit was located at the Indian Agricultural Research Institute, New Delhi. In the study of bud sports in citrus, at Saharanpur, out of 16 probables detected, only two appeared to be superior to the normal fruits.

In the Punjab, gibberellic acid applied as aqueous spray in 10 p.p.m. concentration to the young budlings of *malta* Blood Red showed the maximum beneficial effect in the series pertaining to the lowest vigour group.

Guava

At the Horticultural Research Station, Krishnagar, West Bengal, Harijha appeared to be the best variety followed by Safeda. At the Fruit Research Station, Dhaulakuan, Himachal Pradesh, Kerala, Sebdane-Bhadri, Banarsi, Bhadri, Chitidar, Safeda and Gulabia varieties recorded a high cropping.

At Saharanpur, inter-varietal crosses were made between Allahabadi Safeda and seedless, and Lucknow 49 and Allahabadi *Safeda.*

At the Indian Agricultural Research Institute, New Delhi, sprays of maletic hydrazide (1,500, 2,500 p.p.m.), 2, 4-D (100 to 150 p.p.m.) and sodium azide (1,500, 2,500 p.p.m.) had completely thinned the blossom of the rainy season.

The chemical sprays were found effective only in bud stage of the flowers.

At Pushkar in Rajasthan, in experiments on young guava plants under controlled irrigation conditions, addition of eight ounces of commercial zinc sulphate to the soil gave the best results for a serious guava disease. Injections of 60 grams of pure zinc sulphate in four holes on the four sides of the trunk of a young plant resulted in the cure of the disease.

In West Bengal, *Fusarium solani* and *Rhioctonia bataticola* were found to cause the wilt disease of guava. It was found that both *F. solani* and *R. bataficola* could grow in a wide range of pH from 3.5 to 9.0, but the best growth took place at pH 6.0 to 6.5. The optimum temperature for *F. solani* was found to be 25°C. to 30°C. and for *R. bataticola* 35°C. The thermal death point of *F. solani* was 60°C. and for *R. bataticola* 65°C. The optimum humidity level for *F. solani* was found to vary from 98.5 to 81.9 and for *R. bataticola* between 96.1 to 93.0 per cent.

Litchi

At the Horticultural Research Station, Krishnagar, West Bengal, *Kasbe* proved to be the highest yielder followed by *China.*

At the Horticultural Research Station, Saharanpur, Uttar Pradesh, crosses were made between Extra Early Green × Early Seedless, Extra Early Green × Early Large Red, Pickling × Calcutta. and Calcutta × Pickling under the breeding programme.

At Krishnagar, root pruning induced better yield in *Kasbe* variety. In propagational studies by Jootee, success obtained with Alkathene film (100 gauge) was double to that secured with the use of gunny cloth.

Papaya

Fourteen new types were added to the collection at the Horticultural Research Station, Krishnagar. The Hawaiian type was found to be more susceptible to virus.

At the Agricultural College, Coimbatore, Madras State, seeds of an improved inbred strain of the Co. 1 papaya were multiplied on a large scale for distribution purposes. At the Orange Research Station, Chethalli, Coorg, Coorg Honey Papaya was selected for its familiar but desirable feature of bearing only hermaphrodite or female flowers.

Pomegranate

At the Indian Agricultural Research Institute, New Delhi, the zn chromosome number of varieties Dholka, Muscat white, Kandhari and Patiala was found to be 16 and that of the double-flowered type to be 18.

Grape

At the Agricultural College, Coimbatore, varieties *Anab-e-Shahi, Fakdi* and Bangalore Blue were found to be promising.

At the Horticultural Research Institute, New Delhi, gibberelin at 10 p.p.m. concentration increased the percentage of fruit-set. The size of the bunches and berries was also increased with 50 p.p.m. sprays.

In spacing and training trials of Bhokri in its ninth year, under the Agriculture Department of Bombay, the data showed that the vines spaced widely yielded more than the vines spaced closely ($1\frac{1}{2}$, two and three feet).

Annonaceous Fruits

Varietal studies. In varietal trials at Krishnagar (Bengal), the varieties Allahabad and Washington were found to be superior.

At Kallar, Madras State, the performance of custard-apple on bulls' heart—root-stock continued to be superior.

At Hyderabad, budding was found to be superior to side-grafting in custard-apple.

Loquat

At the Indian Agricultural Research Institute, New Delhi, sprays of Para-chloro-phenoxy-acetic acid 25 p.p.m. increased the percentage of fruit-set in Golden Yellow. The sprays of 2, 4, 5-T decreased the fruit-set.

Phalsa

At the Indian Agricultural Research Institute, New Delhi, the various methods of propagation, inarching and ring-budding showed promise giving 100 per cent and 65 per cent success, respectively. Amongst a large number of plant regulators tried, gibberellic acid (10 p.p.m.) increased the fruit-set.

Pineapple

Maximum fruiting was observed in Giant Kew variety at the Horticultural Research Station, Krishnagar. In propagation trials by discs, fruited stem slices of Giant Kew produced more suckers than the unfruited ones and fruited slices of Giant Kew treated with potassium permanganate produced more suckers than the control.

Date-palm

Altogether 673 suckers were collected at Abohar in the Punjab for planting. The suckering capacity of Hillawi seeded better than Khadrawi. The performance records indicated that suckers of the Hillawi variety established earlier than Khadrawi.

Ber

At Ajmer, the small-round seeded (AZS-3) variety was isolated as a desirable type.

Temperate Fruits

Varietal collections. In Himachal Pradesh, 56 new varieties were added to the varietal collections at the Fruit Research Station, Mashobra, and 13 to the collection at the Sub-tropical Fruit Research Station, Dhaulakuan.

At Srinagar 23 varieties of apple, seven of pear, four of cherry, eight of peach, seven of plum, four of apricot and one of almond were added to the collection.

Pome fruits. In varietal studies conducted by the Department of Agriculture, Himachal Pradesh, the apple varieties Lord Lambourne, Allington, Pippin, Winston, Granny Smith, Sunset and Winter Banana bore a few fruits to maturity and they compared favourably with the other commercial varieties.

In root-stock studies carried out by the Department of Agriculture, Uttar Pradesh, six apple clonal root-stocks imported from England were multiplied by stooling. *M* XIII was found to be a good grower and rooter.

At the Pomological Station, Coonoor, Madras, among the apples, the Metron root-stocks, No. 779 and 778 continued to promote vigour and larger yields in Rome Beauty scion.

In Himachal Pradesh, in apple, grafting in January, February and March and budding in May gave significantly higher take of buds and grafts than grafting in December and budding in June.

Stone fruits. At Srinagar, peach and plum varieties Hales Early, Peshawri, Nectarine, Peregrine, Red Nectarine and Alberta showed a tendency towards early heavy bearing.

Varietal trials on Shipley Early, New Castle and Kaisha varieties of apricot, and Beauty and Santa Rosa and Mariposa varieties of plum were laid out at Kandaghat, Punjab.

The studies on the disorders of stone-fruits in Kumaon region revealed that Ramgarh Maynard, Maynard Chaubattia, Sharps Early and Green Gage varieties of plum were most susceptible to plum line pattern virus. Peach seedlings were good indicator plants for plum line pattern virus.

Spraying plums in dormant season with Sandolin A or euphyton oil on shy and late bearing varieties not only enhanced their yields but also advanced the flowering by nearly three weeks, at the Pomological Station, Coonoor, Madras.

Miscellaneous

All-India Fruit shows. Under the scheme for organisation of All-India Fruit shows of the Indian Council of Agricultural Research, three All-India Banana shows were organised during the period.

The first show for the southern region was organised at Hyderabad, and for the northern region at Calcutta. The first All-India Hill Fruits Show, was held at Simla.

Cytogenetical studies. Cytogenetical investigation of various fruit trees were carried out. Mizotic studies in *Flacourtia sepiaria* (2n = 20) showed that the chromosomes were present in secondary association at metaphase, the basic number was five. A number of varieties of *Syzygium jambolana* were studied and were found to differ in their chromosome number. In the case of the large-fruited variety the 2n number was 16, while in another type it was 55. The somatic and memotic chromosome numbers of *Carissa carendey* were 22 and 11 ; in *Acharus sapota,* 26 and 13. In *Physalis peruviana* polyploidy was induced by treating the seedling with 0.5 per cent, 0.25 per cent colchirine.

Fruit preservation training. Training in fruit preservation was given to farmers at Kodur and Hyderabad centres in Andhra Pradesh.

SPICES AND MISCELLANEOUS CROPS

Ginger

At Nayabungalow (Assam) G/55/1 Nadia Variety and G/55/7 (local) proved to be promising, the former yielding 16,698 pounds per acre. Planting on 1st May was found significantly superior to planting on 1st April.

Turmeric

At Padapalem (Andhra Pradesh) among the *Curcuma longa* varieties, Kessari Duvvur, Nallakatla Pasupa (Vellavari Khandriga) Gummalakshnipuram 2 and Tekurpeta were significantly superior to control local Duggirala.

Percentage of curing (percentage of dry produce to raw turmeric) varied according to varieties and season. Aromatica types gave higher percentages than *longa* types.

Whole mother-rhizomes planted nine and twelve inches apart within the row were superior to planting either cut mother rhizomes or fingers at the same distances. There was no difference in germination due to the nursery media (moist soil, sand, saw dust and paddy straw). Most active phase of sprouting was found during the fifth, sixth and seventh weeks after planting. Farmyard manure application gave a 15 per cent increase in yield over green manuring. Addition of K_2O along with farmyard manure tended to increase the yield.

The wilt disease was effectively checked by drenching the soil with 1 per cent Boardeaux mixture. Leaf mite was controlled by spraying 0.25 per cent solution of parathion. Drenching the soil with merculine or mercuric chloride was very effective in controlling chizome rot.

Clove

In Madras, seedlings from 27 trees selected from Nilgiris, Courtallam, Kanyakumari and Kottayam were planted for observation. Air-layering was found to be possible. Six species of *Eugenia* were found to be incompatible as root-stocks for clove scions. Inarching clove on its own seedling stocks was found to be feasible but with great difficulty.

Nutmeg

High yielding trees were isolated at Burliar. Inarching on six different species of *Myristica* met with success while side grafting and patch budding failed. Grafts planted in 1954 flowered after four years of planting. The trees were low-statured.

Cacao

Five trees from Kallar and one from Burliar were isolated for superior yield performance yielding on an average 55 fruits per tree. Their clones which were placed under trial for study of performance flowered within 1½ years of planting. Layering of shoots was successful during February to August. Inarching on seedling stocks was found possible throughout the year. Side-grafting was not feasible, but shield budding could be done with great difficulty. Patch budding gave nearly 30 per cent success during the months of April, July, August and October.

Cashewnut

The growth and yield of inarched plants was better than that of air-layers. Inarches and layers were better than seedlings in growth, flowering and fruiting. When different age groups of trees were studied, it was seen that with advance in age, the percentage of hermaphrodite flowers also increased. But only 4 per cent of the hermaphrodite flowers matured into fruits.

Seedlings of 32 selected trees from Srikakulam, Tuni and Simhachalam areas were planted at Bapatla. Between 20,000 and 25,000 acres of waste lands in Visakhapatnam and Kurnool districts were adjudged as suitable for cashew cultivation after a survey of the State.

Ca. 119 exotic and indigenous varieties were under study for growth and yield at Mangalore (Mysore State). A maximum tree yield of 115 nuts was recovered by selection 8/5 (Ullal—South Kanara) in the fourth year of their orchard-life. In the progeny-plot, the yield of the Allangudi selection with an average of 184 fruits per tree was the highest in the fourth year of their orchard life.

Propagation by cuttings and heel-cuttings was unsuccessful, but air-layering and inarching was successful. Air-grafting, using two to three months old seedlings as root-stocks, gave a mean success of 65 per cent.

Pepper

At Panniyur (Kerala) progenies of Uttirankotta × Taliparamba I were the most vigorous among the hybrids and possessed all the desirable characters. The other promising hybrids were Uthirankotta

× Kottanadan, and Kottanadan × Taliparamba I × *Piper attanuatum* Balamedha. Nineteen apparently wilt-resistant types were selected from different pepper growing regions of the west coast and their progenies raised for carrying out inoculation and field tests.

In Mysore, a survey was undertaken in the districts of Hassan, Chickmagalur and Coorg, and 150 promising clumps were selected for further study.

In West Bengal, an application of four ounces of superphosphate or a mixture of two ounces of ammonium sulphate and two ounces of superphosphate per plant gave increased yield ranging from 24 to 48 per cent.

Lemongrass

At Odakkali (Kerala), 26 single plants were isolated for their high oil content and citral.

Chillies

In Andhra Pradesh, CA.825, another yellow mutant from G.2, compared favourably with G.2 the standard and deserved to be popularised for its special character roguing facilities. Culture CA.452-1 (NP.46A) which has given consistently higher yields than G.2 in district trials was found particularly suitable for rain-fed areas. New collections from Orissa, Rajasthan, Madras, Russia and Indonesia were added at the Indian Agricultural Research Institute, New Delhi. The F_1 cross N.P. × Puri Red proved to be resistant to mosaic and the resistance seemed to be dominant.

Pencedanum sowa

Diploids showed 2n=22 chromosomes. Colchictine-treated plants revealed tetraploid (n = 22) number. A number of aneuploids (n=9+14) were also found. Number of spores produced in each *P.M.C.* varied. There was 50.6 per cent pollen sterility.

X-rayed plants with high dosage took longer time to germinate.

AGRICULTURAL IMPLEMENTS

The survey of indigenous agricultural implements was completed in the States and the all-India report of the survey was compiled and printed.

A co-ordinated scheme for the survey of additional indigenous agricultural implements was sanctioned in 14 States for one year during 1958-59. The implements not already covered in the first survey scheme, would be included in this scheme, and these are water lifts, chaff cutters, groundnut decorticators, rice processing equipment, bullock carts, etc.

A co-ordinated scheme for the trial of imported and improved agricultural implements was sanctioned for three years with effect from 1-4-1959 in all the States except West Bengal. The object would be to evolve efficient and labour saving agricultural implements for

various agricultural operations in the States from the available improved agricultural implements in different parts of India and other countries.

An all-India scheme for the award of prizes for effecting improvements in 15 selected agricultural implements was sanctioned by the Council. Over 100 machines have been entered in the competition for the award and necessary trials were conducted on these machines by the concerned State Departments of Agriculture. Trials by the States were completed and an *ad hoc* committee was appointed to carry out the final tests.

MILLETS

The project for intensification of regional research on cotton, oilseeds and millets was jointly sponsored by the Indian Central Cotton Committee, the Indian Central Oilseeds Committee and the Indian Council of Agricultural Research and provided for the establishment of nine main centres and eight sub-centres in different parts of the country. Work on millets was planned to be done at the main centres, the Indian Agricultural Research Institute (Delhi) for *jowar* and *bajra*, Kanpur (Uttar Pradesh) for *bajra*, Sirsa (Punjab) for *bajra*, Coimbatore (Madras) for *bajra*, Amravati and Surat (Bombay) for *jowar*, and Dharesgur (Mysore) for *jowar*. Sub-centres Junagadh (Bombay) for *jowar*, Mohol (Bombay) for *jowar* and *ragi*, Sulekri (Mysore) for *ragi*, Bellary (Mysore) for *ragi* and *jowar*, Dharwar (Mysore) for *kharif jowar*, Gwalior (Madhya Pradesh) for *kharif jowar*, and Ajmer (Rajasthan) for *bajra*.

The main centres at the Indian Agricultural Research Institute, Kanpur and Sirsa started functioning in 1958 and in the Amravati Centre set up during the same year after a while the Head of the Centre went back to his parent department centres in other places are due to be started soon.

Recruitment of Class I and Class II Officers for the scheme is being made through the Union Public Service Commission and it is hoped that all officers would be put in position shortly. Plans for buildings and the purchase of equipment are being expedited.

There are a few schemes on millets at present, independent of PIRRCOM running in Andhra Pradesh, Bombay, Madras and Mysore State. The feasibility of amalgamating all these schemes to fit into the framework of the PIRRCOM was considered by a special Subcommittee appointed for the purpose.

The Officer-in-charge of *sorghum* work at the Indian Agricultural Research Institute along with Dr. Rachie would function as Project Co-ordinators for this co-ordinated programme of the millets part of the PIRRCOM.

MAIZE

A Co-ordinated Maize Breeding Scheme started functioning from June, 1957, with the object of evolving hybrid maize of superior quality and high yield, responsive to fertilizers and resistant to pests, diseases and lodging. The work was in progress at the four main

centres—Indian Agricultural Research Institute, New Delhi; Amberpet (Hyderabad), *Terai* Farm and Srinagar—and at the eight sub-centres (Jullundur, Pusa, Arbhavi, Dohao, Kalimpong, Ajmer, Almora and Kangra). Another sub-centre at Chhindwara will be started from this year.

Most of the members of the technical staff were in position during the year ; some of them were under training in the U.S.A. and some posts could not be filled.

All the four main centres and the sub-centre at Ajmer were fully equipped. More laboratory facilities and equipment will be made available shortly.

A course of practical training for a period of four months during *kharif* was organised at the Indian Agricultural Research Institute for members engaged in maize breeding programme in the different States. Three trainess from Andhra Pradesh and one from West Bengal participated in the training. The training was meant to impart knowledge regarding field plot technique, field notes, pollination, detasselling, work in production field and analysing yield data. The training was in two parts: (i) practical work in the field and (ii) a series of highly technical lectures of different experts. The training programme was a success.

The Centre at Hyderabad was specially fortunate, as it could grow two successive crops of maize, one in *kharif* and the other in *rabi*. In all the other centres only one crop in *kharif* was possible. This peculiar condition was taken advantage of and the material that was to be grown in the next *kharif* at the Indian Agricultural Research Institute, was grown in the previous *rabi* season at Hyderabad. Uniform yield trials were conducted at all the centres. Twenty-five U. S. hybrids were tested at all the centres along with three Punjab hybrids, two local varieties and Amarillo de Cuba. The U.S. hybrids were of three different durations, those from the Southern States were the best in general ; and the Lixie and Texas hybrids and N.C. 27 did very well all over the country. Texas hybrids performed well in the South. Dixie 22 and Texas 26 in Hyderabad, Texas 26 and U.S. 578 in *Terai* Local and N.C. 27 at Ajmer, Dixie 82 and Dixie 55 in Almora. Texas 28 and Texas 30 at Arbhavi, Dixie 82 and Dixie 22 in Kangra, and Dixie 11 and Texas 30 at Pusa were the highest yielders. The yields from the above best hybrids varied from 2,732 pounds per acre to 8,550 pounds per acre.

Twenty-eight high-yielding in bred lines were selected from all the centres for multiplication. The female parent of U.S. 578 and N.C. 27 proved to be a very good single cross and was selected for use as the male tester parent in the top-crosses. Among the 49 top-crosses and check varieties tested, G.733W-75 × (WF.9 × 38-11) at Hyderabad and G. 715-261 × (WE. 9 × 38-11) at *Terai* Farm and at Ajmer proved to be the best.

The yield trials conducted at the various centres in a number of localities during the *kharif* 1958, revealed that a number of hybrids were much superior in yield to the local check varieties. Amarillo-de Cuba B_1 × HMI showed 116 per cent increase over the local HMI

at Hyderabad. At Srinagar, G715-244 × (W.F. 9 × 38-11) recorded 173 per cent over the local Anantna. At *Terai* Farm, G.733W-215 × (W.F. 9 × 38-11) gave 232 per cent over K.T. compared to Basi Selected, K.T.41-228 × W.F. 9 × 38-11) gave 120 per cent increase at Ajmer. At Pusa, Texas 26 (Local) recorded an increase of 145 per cent over Jalna.

Observation were also recorded in regard to resistance to diseases, pests and lodging. Some of the important diseases noted were downy mildew (*Selenospora philippinesis*), bacterial diseases, stalk rot, *Puccinia* spp. and *Helminthosporium* spp. Among the insect pests corn borers, *Chilo zonellus* and *Sesamia* spp., were the important ones.

LAC

Indian Lac Cess Committee

The Indian Lac Research Institute at Namkum continued research on both entomology and chemistry of lac. It developed improved lac adhesive for plywood, water-soluble lac, lac wash-primes, certain types of insulating varnishes, etc., and also devised a sand-separating machine, an improved coating machine for producing dry mounting tissue paper and better filler for lac bangles.

Lac Development Schemes

Operated in Bihar, Madras, West Bengal, Orissa, Punjab, Andhra Pradesh, Mysore, Madhya Pradesh and Uttar Pradesh under the Second Plan. The production of lac during 1956-57 and 1957-58 was 13.15 lakh and 11.40 lakh maunds, respectively, against the Plan target of 16.0 lakh maunds.

COCONUT

Indian Central Coconut Committee

The Central Coconut Research Stations at Kasargod and Kayangulam continued research work on introduction and study of exotic varieties, hybridization, cultural and manurial experiments and investigation on coconut pests and diseases. Nine Regional Coconut Research Stations and 38 coconut nurseries with a production target of 3.72 lakh quality seedlings continued to function in different States. The coconut nursery attached to the Central Coconut Research Station, Kasargod with an annual production target of 10,000 seedlings showed good progress. Out of the seven parasite breeding stations proposed to be started during the Second Plan four stations, two in Madras and one each in Andhra Pradesh and Kerala, were initiated. Seven such stations are already functioning under the Committee. *The Coconut Palm*—a monograph and *Coconut Atlas* were published.

Coconut Development Schemes

Operated in Madras, West Bengal, Pondicherry, Orissa, Kerala, Bombay, Mysore, Andhra Pradesh and Assam. Coconut being a perennial crop, achievements during the first two years of the Plan are not available. The Plan target is to produce 0.80 lakh tons of additional coconut oil or 870 million nuts.

ARECANUT

The Indian Central Arecanut Committee continued to organise agricultural and technological research on arecanut cultivation. Out of five regional research stations sanctioned under the Second Plan, four stations, two in Kerala and one each in West Bengal and Mysore, started functioning during the year. At the Central Areacanut Research Station. Vittal, studies into hybridization technology and floral biology, etc., and observational trials relating to germination of seed nuts were carried out. Investigation on the causes of the band disease, carried out under a scheme of the Committee, yielded some useful results. Financial assistance was extended by the Committee to various marketing organisations for the development of co-operative marketing in arecanut and to the universities and research institutions for advance studies in arecanut. *Arecanut Atlas*, containing 23 interesting maps and charts, was also brought out by the Committee during the year.

Arecanut, Development Schemes continued to operate in Orissa, Assam, West Bengal, Kerala and Mysore. The Plan target for production of arecanut is 27.22 lakh maunds.

TOBACCO

During the year under report, the Indian Central Tobacco Committee continued research on various types of tobacco at its research stations and sub-stations besides running a number of schemes in conjunction with State Governments and other institutions both from its normal grant-in-aid and from the special grant made available to the Committee under the Second Five Year Plan. A summary of results achieved is given below.

Central Tobacco Research Institute, Rajahmundry

The cultural improvements involving the treatments of (1) deep cultivation in summer, (2) deep placement of fertilizer and (3) mulching with paddy straw immediately after the first interculturing gave highly beneficial results. The specially noteworthy feature was that the improvement in quality of the leaf had gone hand in hand with the improvement in yield.

An additional treatment of incorporating organic matter in the form of composted tobacco stalks. composted for a period of three months up to the onset of the S.W. monsoon was beneficial in increasing the size of the leaf and improving its texture. A maximum yield of 1,542 pounds of cured leaf of which 1,023 pounds (66 per cent) was the bright grades, was obtained from a plot in which all these cultural improvements were included.

The 16 feet × 20 feet barn favoured by the Institute was found to be beneficial in saving coal worth Rs. 4.50 and able to handle about 30 per cent more leaf in every charge compared to the commonly used 16 feet × 16 feet barn.

It was found that dipping the leaf stalks picked in the last harvest in water for about six hours and more, improved the grades obtained from them after curing. The benefit in terms of money was more than Rs. 20 per 100 pounds of cured leaf which would normally be obtained from such pickings from an acre.

Deep ploughing in summer tended to improve the leaf burn in flue-cured Virginia tobacco slightly as compared to normal ploughing.

Application of Formalin at 500 pounds per acre as a soil treatment tended to improve considerably the stand of seedlings in the seed-beds irrespective of whether or not the seed-beds were sprayed with fungicides later.

Laboratory tests on the control of the damping off disease have indicated that Shell Copper, Coppesan, Blitox and Cupravit could reduce the growth of the fungus (*Pythium aphanidermatum*) considerably.

Application of sulphur at 40 pounds per acre in four different blocks of farmers' fields at Rajahmundry completely controlled the powdery mildew incidence.

Very interesting results were obtained in 1958 in an experiment on the control of cigarette beetle, wooden cases with different types of joints in addition to the normal type used for packing tobacco and different types or treatments of the water-proof paper used for packing, were tested for efficacy in preventing the attack of tobacco by the beetle. The results obtained require further confirmation.

Soils near palmyra trees harboured nematodes to a considerable extent, and that application of Shell D.D. at the rate of 300 pounds per acre reduce their incidence considerably.

A fumigation of Ethylene Dibromide three ounces plus carbon tetrachloride 2 lb. per 1,000 cubic feet killed nearly all stages of the cigarette beetles. The percentage of kill ranged from 62.5 per cent in the case of larvae to 97.5 in the case of cocoons and adults.

Cigarette Tobacco Research Sub-station, Guntur

Deep ploughing in the summer was found to be significantly superior to normal ploughing. Placement of fertilizer six inches deep around the plant proved to be highly beneficial in increasing the yield of cured leaf, bright grades and Total Bright Leaf Equivalent more so with the application of complete fertilizers (N at 20 pounds P_2O_5 at 100 pounds and K 20 at 100 pounds per acre).

The response of *natu* tobacco to N was up to 40 pounds per acre. Amongst the organic manures, farmyard manure, sheep penning and groundnut cake, the latter proved better than the other two.

The farm method of topping at flower head and harvesting from bottom to top as in flue-cured Virginia tobacco instead of topping at about 14 leaves and harvesting from top to bottom practised by the farmers, gave about 27 per cent increase in the cured leaf yield.

For improving the soil structure in the nursery, either sand or groundnut haulms was good and application of groundnut cake to supply 80 pounds N per acre applied in a raw or composed form seemed to be beneficial in the production of more transplants.

Cigar and Cheroot Tobacco Research Station, Vedasandur

It was established that for getting the best returns from cigar tobacco, the optimum combination of cultural treatments should be manuring with 20 cartloads of farmyard manure plus 50 to 100 pounds N per acre, half as groundnut cake and half as ammonium sulphate, topping at 12 leaves and spacing of 30 inches × 20 inches.

For chewing tobacco, the best combination was 20 cartloads of farmyard manure plus 50 pounds N as groundnut cake at transplanting plus 50 pounds N as ammonium sulphate at *mummatty* digging with spacing of 30 inches × 20 inches, and topping at 14 leaves. To ensure quality in this tobacco it seems necessary to top at least a little lower than in the present methods.

Ammonium chloride at 50 pounds N as top dressing appeared to be beneficial in increasing the total yield as well as the first grade leaf as compared to ammonium sulphate.

The variety *Karuvazhai* was found a better yielder than *Vellavazhai*. The Burmese cheroot variety did thrive well under local conditions.

Wrapper trials at high altitudes at the lower Plani hills indicated that good quality wrapper could be produced in all the locations tried. The entire quantity of tobacco produced was sold to the cigar manufacturers, the price ranging from Rs. 4 to 7 per pound.

Application of farmyard manure as a layer to supply 100 pounds N per acre was found very beneficial in securing a uniform and even germination, and also in reducing desiccation and consequent reduction of mortality of young seedlings.

Hookah and Chewing Tobacco Research Staion, Pusa

Application of farmyard manure at the rate of 50 cartloads per acre proved better than green manuring with sannhemp. Mustard cake in addition to farmyard manure as practised by the farmers, increased total yield slightly and first grade leaf substantially.

The organic manures—blood-meal, stera-meal and horn-hoofmeal —were better than inorganic forms. Sterameal was the best in the production of first grade leaf.

Piercing the stem, increased the yield of first grade leaf considerably.

Application of maleic hyderazie was very effective in controlling suckers, and also gave the maximum yield of cured leaf and the first grade leaf.

Wrapper and Hookah Tobacco Research Station, Dinhata

Among the organic manures, urea, blood-meal and horn-hoofmeal produced more first grade leaf than farmyard manure.

Among the varieties of wrapper tobacco tried, Dixie Shade proved satisfactory both under shade and exposed conditions. The quality of the wrapper tobacco produced at the Research Station was very much appreciated by the trade and for the first grade leaf produced in the open and in the shade a price of Rs. 8 and Rs. 12 per pound, respectively, was offered.

Tobacco Research Station, Hunsur

Indications are available to show that artificial mulching with paddy/straw is beneficial in improving the yield of cured leaf as well as proportion of bright grades.

The insecticides, Folidol E. 6050.05 per cent controlled the incidence of aphids better than other insecticides tried.

Application of 40 pounds of sulphur in one dose at planting time controlled the incidence better than the other methods of application.

Hookah Tobacco Research Sub-station, Ferozepore (Punjab)

Continuous tobacco without rotation was found to give better yield and quality than when grown in rotation with maize, potato and *chari*.

The optimum dose of N for hookah tobacco (both for *tabacum* and *rustica*) was 100 pounds N per acre, half as sulphate of ammonia and half as groundnut cake to be applied in two split doses—one at planting and the other at flowering.

The optimum period of transplanting has been found to be middle of February and not later as done by growers.

Twenty-one high-yielding strains, Nos. 218 and 238, were evolved in *rustica*.

Bidi Tobacco Research Station, Anand

The practical achievements of *bidi* tobacco work, in addition to evolution of a higher yielding strain K-20, are manuring the nursery beds with 80 pounds of N as oil-cake and top dressing at 80 pounds N as ammonium sulphur is the best.

The optimum seed rate of $4\frac{1}{2}$ pounds per acre, the optimum range of nitrogen was 80 to 160 pounds per acre in the form of oil-cake depending upon soil conditions, and this together with planting 3 feet × 3 feet and topping at about 11 leaves as leading to a good quality crop of high economic returns.

Bidi Tobacco Research Sub-station, Nipani

An early-maturing strain S-20 was released for general cultivation. In the case of a dry crop it was found beneficial to grow tobacco continuously with any rotation, particularly from the point of view of quality.

Demonstrations on improved cultural practices, disease and pest control, were conducted in growers' fields. Free training in improved methods of tobacco cultivation, handling and curing to those interested in the technique, including staff and officers of Central Excises, Tobacco Extension Service Schemes, Community Projects and Block Development, at the Central Tobacco Research Institute, Rajahmundry and Institute of Agriculture, Anand, was imparted. Seminars on subjects of topical interest to tobacco growers were organised at the Central Tobacco Research Institute. Pure processed seeds and seedlings of improved variety were distributed to growers. Farmers' weeks were held at all the research stations. The Committee gave technical advice to growers by arranging visits of research workers to their fields, and through free distribution of leaflets describing improved methods on the various aspects of tobacco production.

The Committee continued publication of its quarterly journals *Indian Tobacco* in English, *Pogaku* in Telugu, *Tambaku* in Hindi, *Tamaku* in Gujarati *and Tobacco Bulletin* in English.

The Committee's Central Tobacco Research Institute at Rajahmundry participated in the Second Five Year Plan Exhibition organised by the Department of Agriculture at Yenam. The Institute was awarded a silver cup for the best display of exhibits.

OILSEEDS

The target in respect of the production of five major oilseeds, *viz.*, groundnut, rape-mustard, sesamum, linseed and castor was fixed at 75·5 lakh tons for the Second Five Year Plan. The production during 1955-56 was 56·43 lakh tons. Although the production rose to 61·75 lakh tons in 1956-57, it dropped to 60·51 lakh tons in 1957-58, due to unfavourable weather condition at the time of sowing, and partly to reduction in acreage. A record production of 69·19 lakh tons was attained in 1958-59.

The Government of India sanctioned Oilseeds Development Schemes in June, 1956, on an estimated cost of Rs. 28·78 lakhs, to be shared by the Centre and the State Governments on a 50·50 basis. These schemes were sanctioned for Bombay, Madras, Uttar Pradesh, Orissa, Andhra Pradesh and Madhya Pradesh. The schemes are functioning in all the States except Madhya Pradesh.

Further to augment the efforts of this scheme, the Indian Central Oilseeds Committee also sanctioned Oilseeds Extension Schemes at an estimated cost of Rs. 26.94 lakhs, to be met in full by the Committee. These schemes were sanctioned for Uttar Pradesh, Bombay, Orissa, Madras, Andhra Pradesh, Assam, Mysore, West Bengal, Punjab and Himachal Pradesh. All these schemes are functioning, except in Assam, which has yet to submit a scheme to the Committee for its approval. A scheme was recently sanctioned for Rajasthan.

The following steps were taken by the Government of India to secure a substantial increase in production of oilseeds during 1959-60, as a part of their special drive:

(i) A Central Oilseeds Supervisory Committee was set up to review the progress of oilseeds production with special reference to the attainment of targets.

(ii) The State Governments were requested to constitute similar bodies at the State level.

(iii) The Minister of Agriculture was placed in a special charge of the drive.

(iv) Liberalised pattern of financial assistance was sanctioned for groundnut seed multiplication and distribution schemes, being financed by the Indian Central Oilseeds Committee.

(v) Approval of the Government of India to the Indian Central Oilseeds Committee starting 26 special Plan Protection Units in conjunction with the State Governments for a period of two years, at an estimated expenditure of Rs. 34 lakhs to the Committee, was accorded.

(vi) The State Governments were requested to (a) formulate schemes for growing castor on either sides of railway tracks, (b) to make maximum possible use of Broadcasting Stations, (c) gear up State seed farms for multiplication of improved oilseeds, and (d) adopt double cropping, inter-cropping and plantation of castor on bunds, canals banks, etc.

(vii) Short term loans to State Governments for purchase and distribution of fertilizers to growers are to be sanctioned.

Research Schemes

A provision of Rs. 15 lakhs was made in the Second Five Year Plan for carrying out technological research on vegetable oils on decentralised basis, at the existing institutes through the Indian Central Oilseeds Committee. Sixteen schemes on oilseeds milling, solvent extraction, cotton seed oil, castor oil, fatty acids, activated earths, non-edible oils, surface protective coatings and surface active agents, were sanctioned. The expenditure on these schemes will be met by this Ministry and the Council of Scientific and Industrial Research in the ratio of 24.5:5.

Schemes under the Normal Activities of the Indian Central Oilseeds Committee

Seventy-three agricultural research and development schemes, are in operation. Eleven new schemes were sanctioned during the year under report. In order to organise future research in a proper co-ordinated manner on the basis of soil-climate-variety complex, projects for the intensification of regional research on oilseeds was sanctioned, in collaboration with the Indian Council of Agricultural Research and Indian Central Cotton Committee, at an estimated cost of Rs. 21·7 lakhs to the Committee.

During the year under report the Committee released the Monographs on *Solvent extraction of vegetable oils, Rape* and *Mustard*, and *Castor*. The Committee also published *Indian Oilseeds Atlas*, and a pamphlet *Measures for intensive cultivation of groundnut in India* and Quarterly Indian Oilseeds Journals. Hindi translations of some pamphlets were also released.

The Committee entered samples of oilseeds, oils and oilcakes for display in foreign exhibitions. Exhibits were also despatched for display in the "India 1958 Exhibition".

JUTE

The Jute Development Schemes continued to function in West Bengal, Assam, Bihar, Orissa, Uttar Pradesh and Tripura. The target of jute production set for the Second Five Year Plan is 55·40 lakh bales. Production of jute in the first two years of the Second Five Year Plan, *i.e.*, 1956-57 and 1957-58, was 42·88 and 40·88 lakh bales, respectively. The target fixed for 1958-59 was 51·43 lakh bales and the actual production during that year was 51·78 lakh bales. With a view to giving price support to raw jute consequent upon fall in prices, the State Trading Corporation purchased 50 to 70 thousand maunds of raw jute for internal mill consumption and for exports.

The efforts for the development of jute were intensified during the year by the Chief Jute Development Officer who maintains liaison with the jute-growing States for the promotion of the jute production in the country.

Nucleus Jute Seed Multiplication Farm, Pannagarh

The Farm continued to function during the year under the auspices of the Indian Central Jute Committee. In 1958-59, 163·67 acres were sown and put under jute crop, and the production of nucleus jute seeds was 325 maunds.

The Indian Central Jute Committee continued its researches on all its aspects of jute. At the Jute Agricultural Research Institute, Barrackpore, fundamental and applied researches on jute, ramie and other substitute fibre crops were continued and training in improved methods of jute cultivation was imparted to the jute development staff of the different jute-growing States. Demonstrations on improved methods of jute cultivation were also conducted in the Extension centres around the Central Station as also in the jute development blocks in Assam and Uttar Pradesh. Simple varietal trials with the improved variety evolved by the Institute and simple manurial trials were also conducted under cultivators' field conditions in the different States. The scheme for studying the effects of gamma irradiation on jute continued to work under the Bose Institute, and encouraging results were reported. A scheme for improvement of Bimplipatam jute in Andhra Pradesh has started functioning during the year.

At the Technological Research Laboratories, improved jute bags for cement were made and three lots sent to the cement manufacturers for bulk-trials. The results were encouraging. These bags allow practically no seepage and are almost moisture-proof. From jute sticks unbleached pulp was prepared to the extent of 47 per cent. Work on dyeing and softening wool/woollenised jute knitting yarns was carried out with considerable success.

The Economic Research Section of the Committee carried out investigations into economics of jute-growing at the five new centres, *i.e.*, Barasat and Samsi in West Bengal, Chakia in Bihar, Barpeta Road in Assam and Jaipur Road in Orissa.

The Committee continued to publish the monthly *Jute Bulletin*, and issued press notes and feature articles covering the activities of the Committee and important developments of jute trade and industry.

COTTON

Fifty-four research schemes and 22 seed multiplication and distribution schemes were in operation in different parts of the country during the 1958-59 season. These schemes will devise ways to evolve better strains and improve the race of the cotton plant. The Indian Central Cotton Committee approved the release of LL.54 for the irrigated areas of the Punjab, and 9030-G for the Winter Cambodia zone of the Madras State. Another new American cotton released for multiplication and distribution in the West Nimar tract of Madhya Pradesh was A. 51.9. In Marathwada, Bombay State, a new strain, Gaorani-46, was released to replace the existing Gaorani-6.

The experiments conducted under the Committee's scheme for the acclimatisation of Sea-Island Cotton on the west coast of India indicated that the Sea-Island Andrews cotton could be grown with success in the heavy rainfall tracts of Kerala and Mysore, and that in due course, it would be possible to eliminate the imports of cotton. A comprehensive scheme for the development of the Sea-Island Cotton in the States of Kerala and Mysore was undertaken in May, 1957 and now the scheme has been reorganised on a larger scale.

During the year under report, about 1,642 acres were grown under this cotton and 170 bales of lint obtained were auctioned at prices ranging from Rs. 2,850 to Rs. 3,510 per candy (two bales). The target of extension of area under this cotton during 1959-60 was fixed at 20,000 acres in two States.

The Cotton Extension Schemes continued to operate in the nine cotton-growing States. Besides the provision of grants amounting to Rs. 9·20 lakhs made for these schemes, loans to the extent of Rs. 20,97,200 were sanctioned to the different States for the purchase of improved seeds.

According to the All-India Fourth Estimate of Cotton, 1958-59, the area under cotton cultivation was 19.350 acres against a corresponding estimate of 19,426 acres for 1957-58. On the basis of present indications, the target of cotton production for the Second Five Year Plan has been fixed at 60 lakh bales.

Chapter III

ANIMAL HUSBANDRY RESEARCH

CATTLE BREEDING ON SELECTIVE BREEDING *VERSUS* GRADING UP

The Council initiated co-ordinated studies with a view to finding out the relative value under local conditions of selective breeding of indigenous cattle as against their grading up with improved Indian breeds. Schemes on the subject are operating in Orissa (two units), Bihar and West Bengal. One unit in Madras was taken up this year.

Orissa. Selective breeding of Ghumsur cattle *versus* their grading up with Hariana Bhanjnagar started in January, 1958. The experimental herd on 31-3-58 included 102 cows, 74 heifers, 12 bull-calves, 66 sucklings, six Ghumsur and three Hariana bulls. During the year there were 64 calvings, seven deaths and 47 sales.

The average birth-weight of a Ghumsur male calf was 30 pounds and of a female calf 26 pounds. The graded male and female calves weighed 37 and 32 pounds, respectively. Adult cows weighed 377 pounds. There were 15 cases of abortion, two cases of still-births and 12 cases of retention of placentae.

Sixty-eight cows completed lactations under record averaging of 750 pounds in 342 days. With a test of 4·8 per cent. The stripping yield was 1,234 pounds, 14 ounces.

Another similar scheme in Orissa Bolangir concerned Kheriar cattle *versus* their grading up with Sindhi. It is operating since 15-3-1956. During the year under report, there were 66 births, nine deaths and 26 cullings, and the herd-strength increased from 207 to 238.

The birth-weight of Kharier calves was 29·1 and 29 pounds, and for graded calves 36·4 and 55 pounds, respectively, for male and female calves. The average body-weight of audit cows was 396 pounds.

Forty-eight animals completed their lactations with an average yield of 764·4 pounds in a lactation period of 382 days calculated on pail yield and 908.4 pounds on stripping yield. The average fat test was 4·6 per cent.

West Bengal. Selective breeding of local West Bengal cattle *versus* grading up with Hariana at the Harringhata Farm was started in December, 1956. The experimental herd consisted of 309 animals including 139 local cows, four local bulls and three Hariana bulls. During the year, four cows and 11 calves died of various causes.

During the year, 136 cows were serviced. There were 56 calvings.

Bihar. Studies on Red Purnea cattle *versus* their grading up with Sindhi was taken up on 1st January, 1956. It was proposed to compare pure breeding of Red Purnea cattle with their grading up with the Red Sindhi bulls and determine a more desirable breeding policy to follow.

Ninety-two additions were made to foundation stock. There were 17 births and two cullings. The herd strength of the foundation stock thus increased from 74 to 181. The foundation herd was divided into experimental groups and was maintained, fed, bred and milked in accordance with the technical programme. The division of the herd into groups found defective by the Statistician (AH) Indian Council of Agricultural Research, is being revised.

Six Red Purnea and three Red Sindhi trained bulls were used for artificial insemination, 118 collections were made and semen quality studied. Ninety animals were inseminated and 27 were given natural servicing. Only 10 animals have completed lactations under record.

Madras. A similar study involving Umblacherry cattle *versus* their grading up with Sindhi started at Tanjore on 6th January, 1958. The experimental stock consisting of six bulls, 120 cows and 24 calves at heel were purchased during March, 1958. A feeding schedule was laid down in consultation with the Indian Veterinary Research Institute and other arrangements were made for dividing the foundation herd into experimental groups, laying down management schedule and breeding programme, etc., in consultation with the officers concerned.

The cattle stalls were constructed and necessary equipment obtained.

Cross-breeding

The co-ordinated scheme on cross-breeding of cattle in hilly and heavy rainfall areas continued to function at the 10 different centres in the various States with a central bull department at Bangalore. The Council sanctioned units in the States of Assam, Andhra Pradesh, Bihar, Kerala (two units), Madras, Punjab, Manipur, Uttar Pradesh and West Bengal ; two more units were proposed for Mysore and Andhra Pradesh.

The main objectives of the scheme would be to investigate:

1. the possibility of improving milk production by introduction of foreign blood (Jersey) ;
2. the optimum proportion of foreign blood that will enable the animals to thrive and produce their best ; and
3. the effect of packing, storage and transportation of semen on its motility and other qualities.

Breeding was envisaged to be done through artificial insemination with Jersey semen supplied from Central Artificial Insemination Stations, Bangalore and Calcutta. Semen was planned to be sent from these stations by air and rail to the various units.

Work done so far is summarized below:

Central Artificial Insemination Station for the collection and distribution of semen. Bangalore. This station was established in December, 1954 and the main bull depot supplies Jersey semen to cross-breeding scheme centre in the country. A sub-centre was opened in April 1958 at Tollyne, Calcutta.

At the Bangalore Station, besides the Jersey bulls of Sindhi, Tharparker, Hallikar and Murrah breeds were also maintained and there was a steady and progressive improvement in their health.

Semen was supplied to 19 centres including the centres under Jersey cross-breeding scheme of the Council, Key Village Centres and Artificial Insemination Centres of the States. From April, 1958 onwards, the Central Artificial Insemination sub-station, Tollygange, supplied semen to four cross-breeding centres in that area.

This year there was an overall increase in the number of despatches and the quantity of semen supplied to various centres. There were 2,041 despatches consisting of 37,395 cc. of semen of Sindhi bulls and 333 despatches consisting of 4,750 cc. of semen of Tharparkar bulls. In addition, 350 despatches consisting of 6,179 cc. of semen of Murrah bulls and seven despatches consisting of 175 cc. of semen were available for Jersey semen supplied to some cross-breeding stations and it was between 40 to 43 per cent. Motility of semen at despatch was generally satisfactory and ranged between five and four.

The results obtained in various centres are given in the following Table.

Results Obtained At Various Centres

Locality	Date of	Jersy semen record	Cow	Examined for pregnancy	Pregnant	Cross-bred calves born	Cows milk	Marked for Identifical		Bulls castrated
Andhra Pradesh .	July'55	374cc.	839	802	45·60	116	921	1499	39	318
Assam . .	Dec.'55	..	655	..	..	..	..	..	..	..
Bihar . .	April'55	..	113	819	59·7%	84	300	..	..	467
Kerala . .	April'55	5300cc.	980	814	45·3%	285	..	775		212
Chalakudy } . Nayatjinkara } .	Oct.'56	2210cc.	789	250	120	..	782	1019		141
Madras . .	Jan.' 55	7690cc.	3081	1958	67·6%	92	3009	..		162
Punjab . .	March' 56	2760cc.	681	540	18·37%	..	431	21		338
Manipur . .	Oct.' 55	..	186	108	58·3	..	375	953		551
Uttar Pradesh . .	Dec.' 56	..	107	38	39·5%	..	360	..		345
West Bengal . . (Darjeeling) . .	Jan.' 56	..	215	..	..	..	164	822		50

Improvement of Kangayam Breed, Madras

The work was started in July, 1942. Initially, 60 heifers between the ages of 1½ and 2½ years, and born of dams giving 2,000 pounds or more of milk per lactation were selected as the foundation stock. The females were mated with bulls from high milk yielding strain.

Lactation records were kept by effecting complete stripping once in a week in mornings and evenings. During the year under report, 55 cows completed a lactation with over 2,000 pounds, 59 between 1,000 and 2,000, and three with less than 1,000 pounds.

The average age of maturity worked out to 44 months, the range being 36 to 49 months. Udders of some pregnant heifers were massaged and it was observed that the average milk yield of the udder-massaged heifers was more than that of the controls. The average daily milk yield of udder-massaged cows was 8·0 pounds while it was 7·2 pounds for cows whose udders were not massaged. The average fat percentage was 5·2 per cent, the range being 4·3 to 6 per cent. One hundred and ten calves were born, out of which 55 were male and 55 female. The average birth-weigh of bull-calves was 48·0 pounds and that of female calves was 57 pounds, and the minimum weight of females was 31 pounds.

The average rate of increase in the weight of calves was 0·9 pounds daily, the maximum being 1·3 pounds daily.

Livestock Investigation Scheme, Hissar (Punjab)

This work was started in April, 1941. First lactation records of 354 Hariana cows were studied. The percentage of cows giving 2,000 pounds milk and above increased from 24.7 per cent (foundation stock) to 34·3 per cent (progeny) during the year under report, while the percentage of cows giving 1,000 pounds or below decreased from 29·6 (foundation stock) to 5·7 (progeny), thus showing a definite improvement in the milk yield of the herd. The average yield of foundation stock was 1172·9 ±69·50 pounds and that of first generation 1,4637·7 ±49·71.

Records of 674 bulls were investigated for service behaviour and it was observed that the average reaction time was 15·3 ± 0·53 minutes. The fertility rate of the bulls used on the farm for these experiments did not differ much from bull to bull. The average percentage of fertile services was 55.1.

The average birth weight for male calves was 52·4 + 0·35 pounds males and 48 females. The sex ratio of the progeny calculated on the basis of 1,435 births recorded during the past 13 years worked out to 102 males to every 100 females. The minimum calving interval was 326 and the maximum was 697 days.

The average birth weight for male calves was 52·4 + 0·35 pounds and for female calves it was 49·0 ± 0·37 pounds.

Progeny testing of Murrah buffalo bulls, Aarey Milk Colony (Bombay) started from 1st March, 1958. It is proposed to ascertain the transmitability of the Murrah buffalo bulls used for artificial insemination service so that selected progeny of the best bulls may be reared for expanding the breeding programme.

Cattle Sterility

A co-ordinated scheme on cattle sterility financed by the Council started in 1954 and continues to function at seven centres. During 1958-59, this scheme was further extended to Assam, Orissa, Andhra Pradesh, Madhya Pradesh and Kerala, and the officers-in-charge of the new schemes were trained in Sweden.

It is aimed to improve the teaching of Animal Gynaecology and Obstetrics at the Veterinary Colleges and to conduct investigations on problems relating to sterility. In Madras, investigations were conducted on 1,124 animals brought to the Madras Veterinary College Clinic for gynaecological attention. Material obtained from these animals was utilised for imparting practical training to the students and for making further investigations. One hundred and forty-two specimens from gynaecological cases underwent bacteriological and pathological examination; of these 123 were cervical and vaginal swabs and predominant organisms were *E. coli, Staphylococcus, Streptococci, Diplococci, Diphtheroids, Anthracoid* and *Micrococci.* Blood serum samples from six animals tested by agglutination gave negative results. The incidence of retained placenta, vaginitis, hypoplastic genitalia, persistent corpus luetum in cows examined at the college was 75, 3:34, 11:04 and 12:04 per cent, respectively.

At the Indian Veterinary Research Institute centre animals of the Institute as well as of the adjoining areas were examined. In Hariana heifers, the average age at the first heat was 1,161 days while the mean age at the first fertile heat was 1,334 days. In buffalo heifers, the average age at first calving was 42·7 months. From the material obtained from the slaughter-houses during the previous year, the incidence of metritis, foetal resorption and pyometra was found to be 21:74, 4:24 and 1:10 per cent, respectively. In 38 heifers, absence of oestrus was found to be due to sub-functional ovaries. Efficacy of various drugs in the prevention of matritis due to retention of foetal membranes was also studied.

In the Punjab, 393 cows and 266 buffaloes from the Livestock Farm, Hissar, and adjoining Key Village and Gaushala were examined for various gynaecological troubles, and clinical cases of sterility and diseases of genetial organs, brought to the veterinary college hospital, were also investigated. Eighteen cases of retention of placenta in cows and three in buffaloes were treated with diethylstibestrol to find out its efficacy in its expulsion, but the results were inconclusive. The efficacy of standard lugol solution in treatment of anoestrous cases was studied on 39 animals. On first application, 20 per cent of the treated animals were found to conceive. In case of others, the second treatment was given. The results for this will be studied later.

A survey of various farms and villages was conducted in Uttar Pradesh to examine animals for various breeding difficulties. At Madurikund Farm, two buffalo heifers were found to have hydrosalpingitis as confirmed by post-mortem examination. One hundred and ten animals were found to have anoestrous condition.

In Assam, Andhra Pradesh, Madhya Pradesh, Orissa and Kerala, the work was taken up only in January, 1958, and a few preliminary investigations were made.

In West Bengal, besides devoting 1,469 hours for teaching, 156 oestrus cycles in cattle and 84 in buffaloes were followed, and 441 clinical cases were examined for pregnancy diagnosis and anoestrous condition, sexual control, etc. Biometric studies were made on 540 organs obtained during investigation. A number of sterile and infertile animals brought to the Calcutta College were also examined and treated. Two cases of *Trichomonas foetus* infection were detected again in heifers.

Physiological Genetics of different Breeds of Indian Cattle under Adverse Climatic Conditions, Haringhata (West Bengal)

This scheme started on 29th October, 1954 and is due to terminate on the 31st March, 1961.

The object of the scheme is to determine adaptability of Hariana, Gir, Tharparkar, Sahiwal and Sindhi breeds under hot and humid climate of West Bengal and consequent selection of the adaptable breed for grading up local cattle.

Eighty animals were considered and body temperature, respiration rate, blood haemoglobulin count, cell volume, white and red blood cell counts, calcium and inorganic phosphorus in blood serum and other records, feed intake, sex behaviour, breeding, semen quality and milk production were regularly recorded in each case.

The data is being analysed statistically. However, it appears breed differences and differences within individuals are visible.

Studies on Immunogenetics of Indian Cattle, Indian Veterinary Research Institute, Izatnagar

This scheme started in February, 1955. Blood groups of Indian cattle and blood group patterns of the important breeds of cattle were proposed to be studied.

During 1958-59, ten pairs of cattle were used in iso-immunisation for the preparation of reagents. Of these, four pairs failed to show any reaction and from another pair a cow was sent to Gosadan. In one case the titre of antibodies, after an initial rise, fell with each injection gradually to a very low level. Two immunisations produced six fractions of antibodies.

Blood from 102 Hariana cattle from the Institute herd, typed at the Blood Grouping Laboratory, Copenhagen, Denmark, showed that almost all the antigenic factors known to occur in cattle blood were present in this herd. Further blood grouping of cattle was done to facilitate the production of reagents according to international terminology. Two reagents K and Q were obtained.

Blood of another 100 cattle was proposed to be examined at Copenhagen and efforts made to obtain deep freezer unit, a centrifuge, etc., so indispensable for the immunogenetics work.

Study of Quantitative Inheritance

This scheme started at the Indian Veterinary Research Institute, Izatnagar, in March, 1956, and terminated in March, 1959. The objects were to set up a *Drosophila* laboratory for fundamental studies on quantitative genetics using characters of economic importance such as egg size, egg production and fertility with approved genetical models, in order to develop simple techniques for large animal selection experiments.

The work under the scheme could not progress according to schedule. Lack of equipment and other facilities retarded initial progress. Literature on quantitative inheritance in *Drosophila* was reviewed. Individual female flies trapped in the open (using ripe banana as bait) were raised separately on a standard medium developed by Burdick in 1954 and 63 cultures from Nayabasti, Bareilly, eight from Matunga, Bombay, and two from Bantval, Mysore, were established. Considerable variation was observed in the sex ratio of the progeny raised from eggs laid by the captured female. In Nayabasti flies, the ratio varied from 33.33 to 65.85 per cent males with the average at 48.48 per cent, in Matunga, flies on an average it was 45.51 per cent males with the range being 41.24 per cent to 77.78 per cent and in Bantval it was 48.66 per cent males.

Two types of male flies were distinguished ; one with light and the other with dark tipped abdomen. They did not cross showing that they belonged to distinct species of *Drosophila*. Tests with standard *D. metanogaster* revealed that the dark tipped abdomen male type represented the same species.

Thirty-seven cultures of the local *D. melanogaster,* each tracing back to a single female caught in the open and 10 mutant stock are being run. Of these 16 are in the ninth generation, and the rest in sixth or seventh generation of mass culturing.

SHEEP BREEDING

Improvement of Sheep and Wool

A co-ordinated research programme for this purpose was sponsored by the Council on a regional basis, and the sheep raising areas were divided into three main regions: (1) the temperate Himalayan Region, (2) the dry Northern Region, and (3) the Southern Region. In each region a main research centre with substations in the adjoining states or sheep breeding areas, were established with the co-operation of the respective State Governments.

Temperate Himalayan region comprising hilly regions of Uttar Pradesh, Punjab, Himachal Pradesh and Kashmir. Strains of sheep yielding apparel wool would be evolved in this region by undertaking systematic cross-breedings of the selected indigenous stock with the rams of imported Raboullet or Merino sheep.

In Uttar Pradesh, Pipalkoti in temperate Himalayan region of upper Garhwal is the main centre. The grading of Rampur Bushair sheep with the Rambouillet rams has reached F2 stage ; and pure breed Rambouillet flock increased to 39 animals. Two rams were

transferred to the sheep Farm Gwaldom and Stud ram centres at Manura and Daragaon. The number of F1 progeny increased to 113 and the F2 progeny to 18 sheep ; in addition, 68 Merino half-bred and 301 Merino quarter-bred were reared among the flocks owned by private breeders. Many Stud rams were distributed. The imported pure-bred flock survived and multiplied satisfactorily.

Brogaon and Manurwa are provided with pure-bred Merino and Merino cross-bred rams produced under the scheme and a few rams at Stud Ram Centre Giria, were also supplied from the Pipalkoti farm. The research station can supply 20 to 30 Stud rams for field extension work annually.

Eighteen adults were available for mating and five to each ram were allotted for mating during the year. Fourteen lambs were born. One, ewe gave birth to twins.

Wool quality of the pure-bred Merino progeny was the same as in the imported sheep but the wool yield was lower than clip obtained from the original few sheep. In Himachal Pradesh, selection was carried in a flock of Rampur Bushair Sheep for evolving a non-hair uniform fleeced strain and to undertake a cross breeding programme with the Rambouillet rams to ascertain whether fine-wooled sheep could be reared in this region.

Fifty-two males and 54 females were born to 106 ewes, the average weight of the lambs being 4.5 and 4.44 pounds for males and females, respectively.

The average quantity of wool yield was three pounds three ounces for rams, one pound fourteen ounces for ewe, one pound nine ounces for lambs, and one pound fourteen ounces for Hoggats.

Seventy-four indigenous ewes, and two rams were purchased. Six Rambouillet rams for cross breeding programme arrived in July from U.S.A. Twelve ram lambs were sold to the Badhyat Development Block.

At Banihal Riasi in Kashmir the local flock were crossed with the Merino and Rambouillet rams with the object of producing superior fine-wooled sheep.

Dry northern region comprising Rajasthan, South-West Punjab, Saurashtra, North Gujarat, Kutch and some parts of Uttar Pradesh. In Rajasthan, about 2,000 acres of land were acquired at the Jor Beer, about four mile from Bikaner. A building is under construction and Rs. 86,000 were placed at the disposal of Public Works Department. Some huts for staff, tin sheds for store and sheep pens were constructed. Veterinary instruments and appliances, stock of medicines, a tank to serve as a water reservoir, and other items of requirements at the research stations were purchased. Vallabh gardens appear more suitable than Jor Beer allotted for experimentation. A foundation flock of 145 ewes and seven rams of Chokla breed including 11 nannies were purchased.

Improvement of the Chokla breed of sheep for obtaining fleeces with their and non-medulated wool is aimed at.

In North Gujarat at Joria Potan, selective breeding between the two important breeds of sheep of North Gujarat was undertaken for evolving new types of sheep carrying non-hairy, finer and heavier fleeces. Climate during the year proved unfavourable for the sheep.

During 1957-58 in studies on selective breeding among Kutchi Patanwadi sheep, in four rams, out of 10 breeding rams, were selected to head the flock of 105 ewes. The tapping and lambing percentages were 94.3 and 74.7, respectively. Seventy-five lambs (40 males and 35 females) were born during the year. The average birth-weight of the male and female progeny was 6.75 and 6.30 pounds respectively. The average wool yield was 23.8 ounces in case of ewes and 41.6 ounces in case of rams. The clean wool yield was 68.08 per cent.

From Kutchi-Marwadi sheep, 33 ewes were maintained at the farm and two rams were selected to head the flock. Twenty-one lambs 13 males and eight females were born. The tupping and lambing was 97 and 80 per cent, respectively. The fleeces of the progeny has 59 per cent of *medullated* fibres as compared to 53 per cent in their mother. The average fibre diameter of the fleeces of both the mother and their progeny was of same order, being 34.81 and 34.80 microns, respectively. The fleece density was 884 fibres per sq. cm., in the mother 958 fibres per sq. cm. in the progeny. The average wool yield was 26.90 ounces in ewes and 45.62 ounces in rams, the clean wool yield was 60.97 per cent.

Southern region comprising Bombay, Mysore, Hyderabad, Madras and parts of Madhya Pradesh. New breeds of sheep carrying superior fleece adopted to the different environmental conditions of the Deccan by the grading up of Deccani ewes by the Merino rams and to use the stabilized cross-breed strains for sheep improvement programmes is proposed to be evolved. In the Nilgiris, sheep with better and more wool are proposed to be evolved through selective and cross breeding with the Romney Marsh rams.

In Poona (Bombay), a flock of 50 selected ewes was mated to two selected rams. Thirty-eight lambs (10 rams and 19 females) were born during the year. The average birth-weight of lambs was six pounds and the rate of growth 1.20 pounds per week up to the age of 18 weeks. The quality of fleeces of mother and progeny was similar. The fleeces of the progeny contained 16 per cent of *medullated* fibres and the average fibre diameter was 34.85 microns. The average wool yield was 17 ounces in the superior grade and 21 ounces in the first and second grade. The fleeces of the third grade weighed 19 ounces.

During cross-breeding (forward mating toward Merino), thirty-two Deccani ewes, 21 with quarter Merino blood and 19 with half the Merino blood, were mated to four selected 75 per cent Merino-bred rams. The progeny from the Deccan ewes and 75 per cent Merino rams carried superior fleece than their mothers. The *medullation* decreased from 50 per cent in the ewes to 26 per cent in the progeny. The fibre diameter reduced from 49.34 microns to 31.45 microns. The progeny from 56 per cent Merino bred ewes and the 75 per cent Merino rams also carried superior fleece than their

mothers. The fibre diameter reduced from 31·44 microps to 25·52 microns. The fleece density increased but the hairiness decreased. The quality of fleece of the progeny from the 50 per cent Merino bred ewes and 75 per cent Merino rams was similar to that of their rams.

Nineteen Deccani ewes and fourteen ewes with the fifty per cent Merino blood were mated to two rams of the 87½ per cent Merino blood. Twenty lambs were born. The progeny from the Deccani ewes carried superior fleece. The fibre diameter was 40.89 microns in fleece of the Deccani ewes and 26.97 microns in the progeny. The quality of fleeces did not improve in progeny from half-bred Merino ewes.

In forward mating towards Rambouillet, 43 Deccani ewes were mated to the available Rambouillet ram No. 0075. Thirty ewes lambed gave birth to 31 lambs. Fleeces of the progeny showed improvement in quality. The hairiness reduced from 32 per cent in the Deccan ewes to 12 per cent in the progeny. Fibre diameter and fleece density of wool improved from 49·80 microns in the dams to 28.60 microns in the progeny and 827 fibres per sq. cm., in the dams to 2,082 fibres per sq. cm. in the progeny.

Selected rams were supplied to the flock owners for grading their sheep and to study the improvement effected. A reduction in *medullation* fibre diameter and increase to fleece density was apparent in Madras—Nilgiris at the beginning of the year there was a flock of 527 Nilgiri sheep and 10 Romney Marsh rams, and entire emphasis was laid in getting as many cross-bred lambs as possible. A flock of 385 ewes were matèd to the Romney Marsh rams and 162 ewes lambed 174 lambs. The average wool yield in Nilgiri sheep was one pound four ounces, in Romney marsh rams seven pounds fifteen ounces and in cross-bred ewes and rams two pounds five ounces and two pounds nine ounces respectively. Twenty-four selected rams were distributed in the rural area for improvement of the village flock.

Eastern region comprisig Bihar, Orissa, West Bengal and Assam. The adaptability of the Romney Marsh and Gaddi breeds of sheep to local climatic conditions and propagation of suitable breeds was tested.

At Gaya Bihar, the scheme started in 1953 pertained to grading up of Chhotanagpur sheep with the Gaddi and imported Romney Marsh rams.

This year, 391 lambs were obtained by crossing Chhotanagpur ewes with the Romney Marsh rams and 75 lambs by crossing Chhotanagpur ewes to the *Gaddi* rams.

The Romney Marsh F1 ; progeny showed improvement ; the average wool yield show three types increase, being 13.64 ounces quality of wool was also superior, *medullation* being 52.95 per cent and fineness 33·66 per cent. The fleeces of rams had 71·99 per cent *medullation* and fineness 43·38 microns only.

Gaddi rams progeny also showed improvement in wool quality. The average *medullation* of progenies was 57.93 per cent and fineness 40·89 per cent, the same figures for the fleece of the rams was 75·58 per cent and 48·38 per cent, respectively.

GOAT BREEDING

Uttar Pradesh

The scheme commenced originally at Pipalkoti from 1st April, 1950 and was later transferred to Gwaldom (District Garwal) during 1955.

It is proposed to evolve under north Indian hilly conditions an Uttar Pradesh type of Angora Goat suited to the Himalyan region by crossing white long-haired hill goats with the imported Angora bucks.

During 1958-59, four F4 progeny (two males and two females) were born. F3 and F4 kids were stunted in growth comparing F1 F2. The average intervening period between two Oestrus was 16 to 20 days and growth of Mohair was more from April to September than during October to March, indicating poor matural feeding during winter. Growth was observed to be retarded in castrations performed before the age of six months. Continuation of grading programme beyond third generation did not appear sound.

Bombay

The scheme commenced from April 1st 1957 and will expire on 31st March, 1962. Experimental breeding trials for evolving new types of goats for Mohair production by grading the local goats with the Angora bucks and to study their potentiality for meat production was proposed to be undertaken.

The breeding trials were undertaken with a few animals and only 14 kids were born during the year from 14 goats. The foundation flock was purchased and Angora bucks are awaited.

Punjab (Hissar)

The scheme is working since November, 1939 and was to terminate on 31st March, 1959. The object was to establish a pure herd and increase milk yield of Betal goats. The average milk yield of 145 lactations was 412 pounds five ounces against 449 pounds six ounces of the last year. The daily average was two pounds two ounces and maximum average three pounds four ounces. The average lactation period was 191 days against 222 days of last year, the dry period 147 days against 165 days of the last year ; and kidding interval 405 days against 398 days of the last year.

West Bengal

A scheme for development of the mutton breed of goats was sanctioned for a period of five years starting from 1st August. 1955 Heritability studies were undertaken. During the first season, 56 nannies of the Black Bengal breed were bred, giving birth to 75 male and 62 female kids. Twenty-four Black Bengal nannies were mated

to the Barbari bucks for cross-breeding, resulting in 25 male and 21 female kids. In the second season, there were 38 kiddings under the selective breeding group giving birth to 55 male and 33 female kids. Sixteen kiddings—17 males and 18 females resulted from cross-breeding. In the third season, 11 does of the Black Bengal breed kidded and 17 male and 17 female kids were born from the third season mating selective breeding programmes. Two nannies of the cross-breeding groups were bred to the Barbari buck which produced two male kids.

POULTRY BREEDING

Poultry Development Scheme (Kerala)

The studies on annual egg production of the pullets, seasonal fertility and hatchability of eggs set for incubation were continued during 1957-58 on the original exotic breeds—white leghorn and Rhodes Island Red.

During 1958-59, 32,794 eggs were produced. The average annual production on per day basis was 187.5 and 171.7 eggs for White Leghorn and Rhode Island Red breeds, respectively. A study of seasonal fertility and hatching showed that the highest fertility was from July to November and the lowest in April and May. Hatchability was low during all the months.

Commercial Chick Hatchery and Poultry Processing Plant Katpadi (Madras State)

The scheme started in June, 1955 expired on the 31st May, 1958, and was further extended for three years. The object of the investigations on the possibility of establishing a commercial hatchery and processing plant under local conditions continued as usual. During 1957-58, 29,574 chicks hatched out. 38,006 chicks were handled while 23,858 birds—46 per cent males and 54 per cent females, were sold to village farms, 6,772 to individuals, 5,728 to N.E.S. Blocks 8,020 to Madras Government, A. H. Department and 2,000 to Kerala A. H. Department. Of the 25 village farms established were closed at the request of the custodians. Eight hunderd and forty-five birds were slaughtered and sold as frozen poultry meat which had gained popularity in the neighbourhood but could not be supplied to the markets in Madras and Bangalore due to lack of transport.

Scheme to Raise 20,000 White-leghorn Chicks and Distribution thereof to Villages by Y.M.C.A., Madras State

This scheme started in August, 1957 will terminate on the 31st March, 1961. It is desired to saturate Martandam and its surrounding villages with high-yielding White Leghorn and to establish a commercial hatchery. During the period under report, out of 5,530 eggs 2,244 chicks hatched. Four hundred and twenty-three birds were distributed and 35 were supplied as foundation stock.

Cross-breeding in Poultry, Allahabad Agricultural Institute

The scheme started in May, 1956 will continue up to 1961. A comparison of efficiency of straight forward cross-breeding against recurrent reciprocal crossing in poultry with a view to collecting

basic information to determine a policy of breeding for commercial production is aimed at. Chicks hatched during 1956-57 were raised separately up to two months of age and sexed, the cockerrels being removed. The mating for the second generation occurred in October. In 24 hatches, 4,303 eggs were set and 2,005 chicks obtained. The hatchability per cent for fertile eggs varied from 34·9 to 72·9 while for all eggs it was 46.6 Cross-bred chickens were heavier up to four months age, later their weight was more than White Leghorn and less than Rhode Island Reds. Cross-breds with Rhode Island Red as male parent were slightly heavier. The chick mortality up to eight weeks and 24 weeks was 22:3 per cent and 24·1 per cent, respectively.

Duck Breeding Scheme, Indian Veterinary Research Institute (Izatnagar)

The scheme commenced in December, 1955 with a view to exploring a possibility of rearing and breeding pure-bred of Khaki Campbellducks without elaborate arrangements.

On April 1st, 1957, there were 42 ducks and drakes of the parental stock and 88 ducklings of F1 generation of the imported flock. Heavy mortality in the flock due to virus Heptitis obliged their transfer to Division of the Indian Veterinary Research Institute, Mukteswar, for further disease (Pathology and Bacteriology) investigation. Hatching eggs were obtained from the flock at Midnapur.

Of the 300 Khaki Campbell eggs obtained, 226 eggs were set for incubation and 56 ducklings were hatched. Cold brooding was practised. Average body weight of duckling at eight weeks was 39.5 ounces while the mortality was reduced to a minimum due to better rearability and proper management. The age at sexual maturity in 23 F1 ducks of imported stock ranged from 123 to 161 days, average being 138·27. Effect of stibestrol implantation in four pullets at 15 milligram each was studied and it was seen that the treated drakes lost interest in ducks as well as fighting tendency, but the voice was unaffected. The average age of sexual maturity in F1 ducklings was 138.27 days.

Duck Breeding Scheme, Kerala

The Scheme started in November, 1954 with the object of studying the economic qualities of Indian runner and Khaki Campbell ducks when raised under ideal conditions of housing, feeding and managements to establish suitable strains for upgrading local ducks, and to conduct studies on incubation, rearing, nutrition, disease and other problems of duck industry.

Initial performance of the birds was poor. They displayed a complete deterioration primarily due to an infection of Duck Virus Hepatitis and the entire stock was, therefore, disposed of and selective breeding of the indigenouus ducks was only undertaken. Two hundred ducks and 40 drakes were proposed to be purchased for the purpose.

A survey was conducted to determine behaviour of hatching eggs sold from the farm against those incubated in the farm, those incubated and reared outside gave a slightly better performance.

Schemes for investigation of diseases of cattle, buffaloes, sheep, goats and poultry, and on specific disease problems continued to function in almost all the states and at the Indian Veterinary Research Institute, Mukteswar and Izatnagar.

Bovine Mastitis

The object of the scheme is: (1) to study the prevalence of the disease in different parts of India ; (2) to determine relative incidence and importance of different micro-organisms involved in its causation ; (3) to evolve suitable laboratory and field diagnostic methods for detection of the disease ; and (4) to assess the efficacy of different methods of treatment and control under local conditions, both in regard to cost and availability of drugs.

In Bombay, examination of 608 milk samples from 153 buffaloes, 171 samples from 45 cows and four samples from goats belonging to different dairy farms and from veterinary hospitals revealed the presence of mastitis organisms in 29.9 per cent cows and 28.7 per cent buffaloes. Fifteen animals were observed to have blind teats while two buffaloes had five functional teats. Among the affected cows seven had latent infection, four early clinical and two advanced clinical infection. One hundred strains of micro-organisms isolated from positive cases on bacteriological examination consisted of 41 Str. agalactae, 14 Str. dysagalactiae 11 *Str. uberis*, 31 *Staph aureus* and three *Cory pyogenes. Str. agalactise* was isolated from a boil on the udder of a goat ; this had caused mastitis to the goat. The affected animals were treated, rather successfully, with penicillin, a combination of penicillin, dihydrostreptomycin, sulphamezathine (with or without cobalt sulphate) and terramycin.

In Uttar Pradesh, a systematic survey for the disease was carried out in a dairy herd of 173 cows and 81 buffaloes at Kalsi and Mauthura Farms. The disease incidence was 32.6 and 15.6 per cent 5.4 and 4.5 per cent in buffaloes, respectively ; it was higher in older cows. Frequency distribution of the various isolated micro-organisms revealed that the staphylococcal form of mastitis was most prevalent followed by the infection caused by *Str. dysagalactiae*. The leucocytic count test was the most reliable diagnostic test.

In vitro and *in vivo* trials were made for efficacy of the various antibiotics aureomycin, penicillin, streptomycin, terramycin and sulphamezathine, singly or in combination (with or without cobalt). Treatments with a combination of penicillin, streptomycin and sulphamezathine with traces of cobalt sulphate showed a markedly greater activity against all organisms as compared with penicillin alone.

The Madras centre started functioning in June, 1957. The survey work was mainly confined to mastitis cases brought to the college hospital for treatment. Investigations on 58 animals were made at three livestock and dairy farms. Two hundred and twenty-four and 180 quarter milk samples from farm and hospital animals were subjected to both direct and indirect diagnostic tests. A cultural examination of milk samples revealed that *Str. agalactiae, Str. dys-*

galactiae. Str. uberis, Str. equisimillis, staphylococcus group, diphtheroids, and micrococcus were responsible for the disease. Streptococci were most prevalent. A positive correlation between the advance of age and incidence of mastitis was indicative. The leucocytic count and microscopical examination of incubated milk gave a higher correlation with cultural examinations. Four mastitis cases were treated satisfactorily with combination of penicillin and streptomycin (with or without sulphamezathine).

The Indian Veterinary Research Institute Centre besides continuing to assist the state centres in typing of the casual organisms isolated at the various field stations, surveyed the Military Dairy Farms at Kirkee, Pimpri, and Banglore, where the incidence of mastitis was found as high as 21, 33, 3 and 30.1 per cent in cows and 15.5, 26.8 and 13.0 per cent in buffaloes, respectively. A very high correlation was observed between the cultural examination and leucocytic count test. A number of chemotherapeutic agents and antibiotics were tried either alone or in combination with each other for treatment of various types of mastitis, and among these a combination of penicillin, streptomycin and cobalt gave the best results.

Six out of 10 buffaloes harbouring *Staph. aureus* infection were successfully treated by administration of two doses of *autogenous* vaccine-*cum*-toxoid prepared from 12 strains of organisms isolated at the same farm.

Brucellosis

Investigations on brucellosis were carried out in Uttar Pradesh, Madras, Bihar and Orissa with a view to determining its incidence, allied infections and their control.

Investigations on brucellosis were carried out in Uttar Pradesh, was found to be 5·6 per cent. highest (19·9 per cent) at the mechanised farm Saidpur where both the healthy and the diseased herds were bred by natural service using the same bulls, one of which was diseased. A programme was chalked out for control and all uneconomic brucella positive cases were removed to Gosadans while the positive productive animals were left in Mechanised State Farms, Madhurikund and Saidpur. At the latter farms, a systematic work is envisaged for obtaining disease-free progeny from infected cases and to salvage the affected animals by different methods. Periodical testing would also be carried out and a non-reactor herd established. The brucella-free farms would form 'closed herds' and introduction of fresh animals strictly controlled. A second test of the incidence of the disease in the 16 herds within a year showed a fall from 5.6 per cent to 2.5 per cent, indicating the efficacy of the control programme.

The spread of the brucella infection in rural areas was controlled by periodic testing of breeding bulls operating in these areas. During 1958-59, 219, bulls located at all-India centres and key villages were tested with negative results.

The disease did not spread to sheep and goats maintained along with infected bovines on the same pastures in the State Farms.

The scheme in Madras started functioning in June, 1957. During the year under report, a survey was conducted in the districts of Salem and Coimbatore in accordance with a plan drawn up in consultation with the Council's Statistician. From 55 villages and five urban centres, blood samples from 2,546 animals were tested by quick agglutination test and among these 25 animals were found positive. Twenty-six samples of sera were tested at the laboratory for assessing their agglutination titres. Of these, 23 were positive and their titres were fairly high, being one in 640 or one in 1,280. Eight samples of milk and vaginal swabs were also examined culturally for isolation of *Brucella abortus*, but the casual organism could not be isolated in pure culture from any of these. One thousand two hundered fifty-five c.c. of *Brucella abortus* plate antigen was prepared for tests.

To facilitate the investigation, ten Veterinary Assistant Surgeons from different State Farms and laboratories were given a short training in the methods of collection, examination, preservation and despatch of materials from suspected cases of brucellosis.

The scheme in Orissa and Bihar is expected to start in the near future.

Contagious Bovine Pleuropneumonia

This scheme has been in operation in Assam since 1951. With the object of studying the incidence and epizootiology of contagious bovine pleuropneumonia in that State and for evolving suitable methods for its diagnosis and control as well as preventing its spread to other states. In Assam, the disease was confined mainly to four districts extending over 200 villages with a total area of 150 square miles and a cattle population of approximately 1,20,000. Systematic vaccination and adoption of proper control measures in Goalpara district, once a hotbed of this infection, has made it almost disease free.

In other endemic areas, vaccination of animals with the live virus vaccine was intensified. Affected animals treated with sulphamezathine sodium solution and tablets showed encouraging results. The whole blood agglutination test gave very reliable results in detecting clinical and subclinical cases under the field conditions.

The causal organism of the disease was successfully grown on the growing chick embryo.

Lumbar Paralysis

The scheme investigating the aetiology of lumber paralysis in sheep and goats continued to function in Orissa. Betal goats imported from the Punjab and their graded progeny were mainly affected.

During the year under report, a study of the periodicity of microfilaria of *S. digitata* in the bovine peripheral circulation showed that the parasites were more in number during early mornings when the animals were still resting, and less during the day.

Attempts to reproduce the disease in Swiss albino mice by intracranial injection of cerebrospinal fluid from affected animals proved unsuccessful. Treatment of affected animals by parental administration of vitamin B-Complex and vitamin B was unsuccessful.

In the Punjab, aetiology of the disease was further studied. A detailed histo-pathological examination of material from the brain and the spinal cord from three typical cases of the disease showed negative infection of *S. digitata*. A microscopic examination of the blood and a cultural examination of the brain from 22 cases of the disease gave no evidence of presence of pathogenic bacterial organisms.

Humpsore

The co-ordinated scheme for the control and treatment of humpsore among cattle was sanctioned for Assam, Orissa and West Bengal. Of the 24,700 cattle surveyed in Orissa, 2,556 positive cases were detected, the incidence of the disease was highest (21 per cent) during July and lowest (10 to 13 per cent) from February to May. Animals four years old and above were usually found to be affected, the incidence of disease was the highest among the Hariana, Sindhi and graded bulls.

Morphology of four male and ten female parasites and their larvae was completely described. *Microfilaria* recovered from oozing blood from scraped lesions and the peripherial blood differ in length and other respects and may belong to *Stephenofilaria* and species. Life-cycle of *S. assamensis* was studied. One thousand and forty clinical cases of humpsore were treated with Hetrazan and Novolap. Hetrazan was used in two to five per cent ointment with two per cent Buty-sulphate and 0·1 per cent Proflavine hemi-sulphate in vaseline base, and a moderate healing effect was noticed in 15 days' time. Novolap used as a paste, daily for 15 days, was also found to be equally effective.

In West Bengal, the infection was found to be prevalent in almost all the districts surveyed. Usually, over two years old cattle were found affected. Sores observed throughout the year were more common during April and May. The animals imported from other states appeared to be more susceptible to the disease than the local cattle. An examination of fresh blood from ear-veins of 185 cattle with lesions and 540 animals without lesions revealed the presence of sheathed *Microfilariae* in six affected and ten unaffected animals. Over 9,000 winged arthropods collected from the body of affected animals and cattle-sheds were dissected and living larvae were encountered in the probescis and head of 28 flies of *Musca* species. The larvae, however, could not be identified. Like last year, direct transplantation of living larvae and gravid females of parasite in three animals could not reproduce the disease. Various drugs including Novolap, Hetrazan, Anthiomaline were tried without any appreciable results. An ointment containing carbolic acid, phenothiazine, DDT in vaseline were tried on 135 animals and initial results were favourable but sores reappeared after two to three months in a number of cases.

Similar studies in Assam are expected to start in future.

Parastic Diseases

Scheme for the control of main fluke disease of bovines with special reference to nasal schistosomiasis continued to function in Dharwar district in Mysore State. The main object is to control nasal schistosomiasis by regular mass medication of affected cattle in selected villages and by treatment of ponds, tanks, pools and river beds, etc., for the destruction of snails, the intermediate host.

During the year under report, 1,200 animals affected with the disease were treated with drugs like Antimosan, Potassium antimony tartrate or combination of sodium antimony tartrate, boric acid and calcium gluconate, and out of them 632 animals were cured both clinically and on microscopical examination of their nasal discharge. Incidence of other liverfluke diseases was also studied by examination of faecal samples of bovines. Out of 88 samples, 51 were found positive for liverfluke ova. These were treated successfully by administration of Hexachlorethane. In order to kill snails treatment of ponds, tanks, etc., with copper sulphate was continued. Besides the four species of snails collected previously, *Lymnae accuminata* was collected this year. The incidence of the disease was highest from September to December.

Another similar scheme is in operation in Mysore since June, 1953. The efficacy of anti-liverfluke medication as a principle measure to control the liverfluke disease under heavily irrigated conditions was aimed at. Systematic dosing of affected animals with anti-liverfluke drug helped to bring down the incidence of infestation to a great extent in the endemic areas. In extensive low-lying areas of Saharsa district of Bihar investigations on the incidence of liverfluke infestation in cattle in the low-lying Kosi areas, their effect on the production and health of animals and methods of control for large scale adoption are continuing.

To assess the incidence of infection, faecal examination of animals in the scheme area was carried out twice in the year, before and after treatment. Mass treatment of animals with carbon tetrachloride was adopted. Several animals reacted after treatment, but they were successfully treated with calcium borogluconate.

Bacterial Flora of Tubular Genetilia and Retention of Placenta, Orissa

This scheme is functioning since December, 1955. The incidence of retention of placeta in bovines in Government farms and the bacterial flora of the female genital tract of healthy and diseased animals is being investigated. At the State Livestock Breeding Farm, Cuttack, the incidence of retention of palcenta amongst 139 calvings, cows and buffaloes was found to be 5.81 per cent and 3.51 per cent respectively, and the incidence of abortion in cows was nil as against 7:01 per cent abortions in buffaloes. In the local *goshala*, the incidence of abortion and retention of placenta was 6.25 and 31.25 per cent, respectively. In cases of metritis resulting from abortion or retention of placenta, usually *streptococci, staphylococci, E. coli* and

Coryne bacterium organisms were found to be present alone or in combination with the brucella organism. Of the 14 clinically recovered metritis cases, nine were found to be bacteriologically sterile and five were found to harbour infection.

General Disease Investigation Schemes

These schemes were sponsored by the Indian Council of Agricultural Research for investigating the aetiology, mode of spread, treatment and control of contagious, non-contagious and obscure diseases of livestock. In most of the states, the schemes have now been permanently taken over by the State Governments. Progress from the various states is briefed below.

Pepsu Region, Punjab. A further survey undertaken determined the geographical distribution and seasonal incidence of important livestock diseases. A great variation in the number of outbreaks of the important diseases was observed this year and their seasonal incidence was also studied. The highest number of outbreaks of haemorrhagic septicaemia occurred during and soon after the summer monsoons (July to October), and the incidence also increased slightly after the winter rains. The foot-and-mouth disease Showed the highest incidence during April, May and June only Generally, the incidence of contagious diseases was higher in the moist areas than in dry and arid regions. Of 1.217 borines and 1,100 poultry birds, 67 bovine and five birds were positive for tuberculosis.

The incidence of Brucellosis, another disease, was studied at the Government Cattle Farm and in adjoining villages. Among 332 animals, 6.0 per cent in the farm animals and 4.6 per cent in the villages were affected. For a study of efficacy and duration of immunity of Anavirus foot-and-mouth Disease Vaccine, 90 animals were vaccinated during the year. Results are yet to be assessed.

The magnitude and regional distribution of Helminthic infestations was investigated on the basis of material collected from slaughter-houses in different localities and on *post mortem* examination of animals ; the highest parasitic infection existed in Kapurthala district, Barnala and Malerakotla subdivisions of Sangrur, district, and tehsil Rajpura in Patiala district. Babesia infection was diagnosed in two dogs and treatment with acaparin gave encouraging results. At several units, coccidiosis in poultry were diagnosed and treated with sulphamezathine sodium (16 per cent) in drinking water and embezin with satisfactory results. A large number of birds was found to be suffering from lousiness, and a DDT or loraxane dust spray successfully eliminated this ailment.

Saurashtra-Kutch region, Bombay. A tuberculin test was carried out at various cattle breeding farms and private *goshalas*. The incidence was, however, very low: out of 396 cattle only two were positive.

Experimental trials with *Cl. welchii* type D vaccine from the Indian Veterinary Research Institute were made on sheep in two villages. Two hunderd and twenty-two sheep were vaccinated. There was enough indication to show that the vaccine confers reasonable immunity. Generally, the vaccine was found to be safe.

Rajasthan. This scheme is operating since July, 1957. Lack of availability of green feed induced high incidence of deficiency diseases with particular reference to Avitaminosis in cattle at the Nagpur cattle farm and the Bikaner Pinjrapole. The disease caused night blindness, calf mortality, birth of blind calves, lymphadinitis, sterility, etc. Provision of green feed controlled the malady. Though surra disease was common in camels, its incidence in horses and cattle in the same areas was low. In transmission of the surra parasite the Tabanid fly played a major role. The fly bred heavily in tanks at different places. A systematic survey of brucellosis undertaken at various Government cattle farms showed that out of 509 animals tested, 16 showed a positive reaction on plate test. Of another batch of 230 farm animals tuberculin tested and four were positive.

Kerala. The scheme is in operation since 1952. During 1957-58, an obscure disease in buffaloes and gape worm infestation in birds of Poultry Farm, Koddappankunnu, was diagnosed. Thirty-nine animals were tuberculin tested by double intradermal test and of these only one was positive.

Mysore. A very high incidence of ephemeral fever was reported from various parts of the State. This was controlled by symptomatic treatment. Five hundred and two pathological specimens suspected of various conditions were received from the field for examination. An epidemic of cutaneous form of anthrax amongst bovines was reported to have spread through biting flies. Cases of obscure paralysis in cattle were observed in 12 villages in South Kanara district.

Diseases of Sheep and Goats in Uttar Pradesh and Andhra Pradesh

In Uttar Pradesh during 1957-59, the incidence of morbidity and mortality due to immature amphistomiasis amongst sheep varied from 24 to 46.5 per cent and from 41.7 to 58.5 per cent, respectively. The amphistomes collected from the affected cases were identified at the Zoological Survey of India, Calcutta, as *Paramphistomum cervi* and *Gastrothylax* sp. This was controlled by dosing sheep with carbon tetrachloride and hexachlorethane. Pneumonia was observed to be a ferquent cause of death in sheep throughout the year with slight increase in the month of January. An analysis of data regarding seizures and deaths due to this disease revealed the average percentage of deaths amongst adult goats and kids as 11.1 and 62.25 per cent, respectively. The corresponding figures in adult sheep and lambs were 38.8 and 33.4 per cent. The causal bacteria isolated from the affected animals were typed at the Indian Veterinary Research Institute as *Klebsiella pneumoniae, Corynebacterium pyogenes, Haemolytic Streptococci* Group 'D', *Staphylococcus aureus* and *Pseudomonas aeruginosa. Salmonella abortus ovis* was also isolated in pure culture from the lung material of a Polwarth lamb which died of pneumonia. Sporadic cases of parasitic broncho-pneumonia due to *Dictyocaulus filaria* were observed among Bikaner sheep which were successfully treated with dictycide.

Occurrence of blow-fly strike in sheep and goats investigated at *Pashulok* revealed that the flies come in large numbers twice a year during March-April and August-September. Sheep appeared to be

more susceptible to this disease than goats. Compared to indigenous breeds of sheep, foreign breeds were still more susceptible. Shearing, dipping, crutching and application of insecticides like dieldrin gave encouraging results in the control and treatment of this disease.

Material from 12 sheep that died of entero-toxaemia was tested in the laboratory and presence of a toxin of *Cl. Welchii type 'D'* was found in it. A vaccine prepared from the scabs of contagious ecthyma in sheep was successful in its control.

In Andhra Pradesh, the scheme was sanctioned during 1953. During the year under report, parasitic infestation of sheep and goats was investigated and the common worms identified included *Monezia expansa, Bumostomum trigonocephalicum Oesophagastomum columbianum, Haemonchus contortus* and *Trichostrongylis, Cotylophoran cotylophorum, Paramphistomum cervi.* The affected animals were treated successfully by the administration of phenovis. After dosing with this drug, a marked reduction in egg count and increase in body-weight was observed. From material obtained from sheep suspected to have died of entero-toxaemia *Cl. welchii* type *'A'* and *'D'* were isolated. Occurrence of anthrax in goats was confirmed. Vaccination with anthrax spore vaccine, which was given in the caudal fold without any untoward results, controlled the disease.

Diseases of Poultry

Andhra Pradesh. The scheme is in operation since 1955. During the year under report. Haemagglutination Inhibition tests were conducted on sera of birds previously vaccinated in the field against the Ranikhet disease. These tests indicated that among the vaccinated birds, the percentage of immune birds was not as high as expected. The Ranikhet chick embryo vaccine was found to confer solid immunity up to 11 months and 19 days in chicks vaccinated at an age of *ca* 48 days.

Birds affected with infectious coryza were treated with dihydrostreptomycin but the effect was temporary. A survey for detecting occurrence of salmonellosis was conducted in 191 imported birds by rapid plate test with negative results.

Indian Veterinary Research Institute. A scheme for control of coccidiosis in poultry is functioning from 1955. It is desired to determine the relative efficacy of certain drugs in the treatment of faecal coccidiosis and to study the effect of treatment with the drugs on the development of immunity in birds after infection. During the year under report, two series of experiments undertaken were abandoned because of adventitious coccidial infection. In another, 100 chicks were employed and infected experimentally. The effectiveness of sodium sulpha quinoxa line and sodium sulphamezathine and nitrofurazone soluble treatments were given at 48-hour intervals after the experimental infection and after the first appearance of blood in the faeces. It appeared that when the treatment started 48 hours after the infection, the two sulpha drugs eliminated mortality amongst the treated groups whereas 26.6 per cent of nitrofurazone-treated chicks died. This indicates the superior prophylactic properties of the two sulpha drugs and a definite beneficial effect of nitrofurazone on the infection.

When the treatment was instituted with the first symptoms of coccidiosis, sulphamezathine gave best result and reduced mortality to 13.3 per cent. Mortality rates in the groups treated with sulphaquinoxaline and nitrofurazone was 40 per cent and 46.6 per cent respectively. Mortality chiefly occurred on the fifth and sixth days in all groups.

The surviving birds withstood severe challenge of inoculation 16 days after the previous infection which indicated that medication with any of the drugs did not interfere with the development of immunity due to initial infection.

Rinderpest

The Rinderpest Eradication Scheme started as a pilot project in the First Five-Year Plan was taken up on a countrywide scale in the Second Plan. It is functioning in Andhra Pradesh, Bombay, Orissa, Bihar, West Bengal, Assam, Uttar Pradesh, the Punjab, Himachal Pradesh and Jammu & Kashmir, Rajasthan, Madhya Pradesh and Delhi have also started field campaign. This year, systematic vaccination of animals was carried out in all these states by the special staff appointed under the scheme and progressively larger areas were rendered free from the disease. The work was completed in a number of districts in each state and new areas were taken up. Except for hill cattle and cross-bred animals, FDGTV was used. In all, 240.5 lakh animals were vaccinated during the year.

The FDGTV was produced at five centres established under the scheme, at the Indian Veterinary Research Institute, Lucknow, Hissar, Calcutta and Ranipet. These centres produced nearly 518 lakh doses of the freeze-dried vaccine. The Indian Veterinary Research Institute also produced lapanised vaccine for vaccination of animals of high susceptibility.

Establishment of land quarantine stations at important cattle routes along the international land border for checking the ingress of rinderpest from the neighbouring countries is under way ; a survey was conducted, and suitable places for setting up the quarantine stations were located. Six quarantine stations on Uttar Pradesh-Nepal border and one at West Bengal-Nepal border were started. Similar stations at other places along the border are proposed to be set up.

DAIRYING

Delhi Survey of Bacteriological Quality of Milk

The main object of this survey, started in July, 1957, was to show the conditions of milk collection and supply and systematic data on quality of market milk in Delhi. An equipped research laboratory was set up for this purpose. The staff recruited received intensive training in sampling procedures, routine laboratory techniques and standard methods of bacteriological examination and chemical analysis of milk. A preliminary survey of important milk collection centres in the districts of the Punjab and Uttar Pradesh situated within a radius 20 to 40 miles round about Delhi, collection centres of the Co-operative Milk Supply Union, Meerut, and milk distribution centres in Delhi was done. Testing of milk has commenced and results are under assessment.

Allahabad city

The main object was to find acceptable standards for raw and market milk, standardise processing conditions and suggest measures to improve the quality of milk. During the year under report it was seen that the containers used by transporters were not hygienic. Cleaning of these utensils in open at public taps was inadequate, so was the handling of milk. The handling of the latter by the Union was fairly hygienic and care was taken for chilling milk during transportation when needed. They utilized scientific ways for cleaning of utensils, equipment, etc. The general condition, maintenance, sanitation of animals and production, and subsequent handling of milk were good in the local Military Dairy Farm.

Milk samples were analysed by physical, chemical and bacteriological tests: organoleptic, protein stability, titrable acidity, fat content, dye reduction, direct microscopic count, standard plate count thermoduric count and presumptive caliform test.

All the samples of mixed milk gave a resezurin disc reading of six in the case of the ten minutes test and from three to six in the case of the one-hour test. On an average, the methylene blue and the tetrazolium reduction times were 260 and 350 minutes. The direct microscopic count averaged 500,000 per ml., the standard plate count, 220,000 per ml. and thermoduric count, 3,200 per ml. The presumptive caliform test was positive in all cases. The acidity and fat content averaged 0.11 per cent and 5.3 per cent, respectively. The work is to continue.

Bombay

The scheme is due to expire on September 1, 1960.

The analysis of milk samples of various societies as received at the Union at Anand was examined bacteriologically.

The bacteriological condition of milk received from different producers' societies at the Union Dairy was found to be of low quality. The quality of pasteurised milk at the Union Dairy was satisfactory due to the efficiency of processing method and absence of post contamination.

Preliminary work on the bacteriological analysis of milk products manufactured by the Union, *viz.*, milk powder, butter, etc., was also carried out.

Pasteurization of Milk in relation to Destruction of Pathogenic Bacteria and Improvement of Keeping Quality

The scheme commenced on June 1, 1955 at the National Dairy Research Institute, Bangalore, originally sanctioned up to May 3, 1958. It was extended for another year for the completion of the work. The scheme was transferred to Karnal with the shifting of the main institution from Bangalore to Karnal.

Over 460 samples of raw and pasteurised milk were collected from two private milk distribution centres as well as two organized dairy farms during the monsoon, winter and summer season of the

year under report. The samples were analysed for their bacteriological quality. The samples of raw milk were heat-treated at 63:5°C. for 30 minutes under laboratory conditions and examined for their keeping quality. The bacterial count in raw milk was very high and pasteurisation reduced it to a considerably low level. The number of bacteria left was less in the laboratory pasteurisation than in commercial pasteurisation.

In both the cases, raw and processed milk, there was considerable reduction in the standard plate count during the winter and summer seasons as compared to the rainy season.

The number of bacteria surviving in raw milk samples, heat-treated at different pasteurisation temperatures, as well as keeping quality of these samples at room temperature and in cold storage, were examined. Studies on the heat resistance of pure cultures of bacteria at different temperatures and holding periods were carried out.

It was seen that strains of *Aerobactor aerogenes* and *Serratia marescens* were destroyed at a temperature of 63.5°C. in 10 to 15 minutes, inspite of high concentration of 5.45 and 15.2 million cells per ml., respectively. All the other strains studied, on the other hand withstood the heat up to 30 minutes. *S. faeculis* with an initial concentration of 0.5 million was destroyed in 15 minutes while at a higher concentration of 1.1 and 7.5 million withstood the heat treatment for 20 minutes. The strains of *B. cereus* and *S. thermophilus* withstood the temperature for 30 minutes at a concentration of 0.835 million and 0.103 million, respectively. *S. liquefacens* at a concentration of 12.5 and 1.37 million resisted the heat treatment for 30 minutes while at a lower concentration 0.75 million the organism survived only for 25 minutes.

Development and Standardization of Methods for Detecting Adulteration and Estimating Major Constituents of Milk, Hoshiarpur (Punjab).

The scheme, started on April 1st, 1955 and due to terminate on March 31st, 1956, was extended for a further period of two years. The object of the scheme was to find a method for detecting adulteration and for estimating the major constituents of milk.

The heat of dissolution of milk in benzene was determined in the case of 45 different milk samples obtained from different animals by a calorimeteric technique specially devised for the purpose. The results obtained showed that this thermal value measured under standard conditions was fairly closely connected with the fat content of milk.

Electrometric titration curves of various milk samples using glass electrode in conjunction with saturated calomel half cell were determined. These curves revealed protein content of milk, on which depended the buffering power of milk.

Flocculation of various whole and skim milk samples with zinc sulphate as electrolyte was studied and it was observed that flocculation value for a given sample not only depended upon its protein

content, but also upon other factors such as storage, *pH* value at the time of the experiment, etc. The addition of even five per cent water lowered the flocculation value of the sample to an appreciable extent. Thus, this method could be useful to detect the addition of water in fresh milk.

Estimating the Amount of Milk Sucked by Calves at Northcote Cattle Farm, Chharodi and Institute of Agriculture, Anand

The object of the scheme was to estimate the amount of milk sucked by the calves of Kankrej cows in which weaning is considered to be very difficult, almost impossible, so that the true producing ability of the cows of the breed could be accurately known.

Northcote Farm Chharodi. The scheme started on August 1, 1957 and 25 calves were included in the scheme up to 31st March, 1958 for estimating the average daily amount of milk suckled by the calves; the latter suckled by a calf during the eight, four week periods after the birth varied from 3.30 pounds to 6.84 pounds with an average of 5.05 pounds. The average daily production per cow, excluding the milk suckled by the calf varied from 11.1 pounds to 13.7 pounds with an average of 12.12 pounds. About 49.5 per cent of the actually recorded milk yield was suckled by the calves during the first 12 weeks after the birth, while the average for the entire period of study was 41.2 per cent.

The average increase in weight per day per calf was 0.906 pounds during the first 32 weeks after the birth. The average consumption of green fodder was 2.36 pounds varying from nil to 5.85 pounds per day per calf during the above period. The average length, heart-girth and height of the calves at birth were 22.6 $\pm$ 0.29, 26.4 $\pm$ 0.32 inches and 27.1 $\pm$ 0·29 inches, respectively.

Institute of Agriculture, Anand. The scheme was started on July 1, 1957. Nineteen calves were included in the scheme upto 31st March 1958 for estimating the amount of milk suckled by the calves. The average daily amount of milk suckled by the calf during the first four, four-week periods after birth varied from 7.40 pounds to 8.92 pounds with an average of 7.98 pounds. The average daily production per cow excluding the milk suckled by the calf, varied from 15.71 to 21.60 pounds with an average of 18.99 pounds. About 43 per cent of the actually recorded milk-yield was suckled by the calves during the first 16 weeks after birth. The milk suckled by the calf increased with the increase in milk yield of the dam.

The average increase in the weight per day per calf was 1.03 pounds during the first 16 weeks after birth. The average consumption of green fodder was 2.12 pounds varying from 0.119 pounds to 4.87 pounds per day per calf during the above period. The average length, height and heart-girth of the claves at birth were 22.64 $\pm$ 0.32 inches, 27.23 $\pm$ 32 inches and 25.89 $\pm$ 0.41 inches, respectively.

Possibilities of Using Milking Cows of Hariana Breed for Work

The scheme commenced on April, 20th, 1953 at the Indian Veterinary Research Institute, Izatnagar, and terminated on May 31st 1958. Red Sindhi and Hariana breeds of cows were under study. A significant decrease in the total amount of production of milk as well

as butter-fat in the working cows in both the herds was recorded. The additional feeding of concentrates to working animals failed to prevent the adverse effect on milk yield. The additional expenditure incurred in feeding cows at work and the loss resulting from the decrease in milk yield could be balanced by the output of work provided in either breed the cow was at least 60 per cent as efficient as bullock at work.

There was no significant difference in either the service conception ratio or birth-weight of calves. In the Hariana cows, however, there was an indication of lengthening of the calving interval.

Sampling of Daily Milk Records for Estimating Lactation Yield of Cows (Statistical Wing, I.C.A.R.)

The objects of the study were to evolve a suitable procedure of sampling the cows as also the days in milk of each selected cow and to develop efficient method of estimation for assessing the average lactation yield and examine the possibility of adopting a rational scheme of supervision on recording of milk yield of experimental cows for securing a sufficiently accurate check on the lactation yield of each such cow.

Consequently, complete daily milk yield records during the first lactation of 65 Tharparkar cows at the Government Cattle Farm, Patna, 36 Hariana cows at the Indian Veterinary Research Institute, Izatnagar, 34 Red Sindhi cows at the Livestock Research Station, Hasur and of 41 Hariana cows under a Council scheme at the Government Livestock Farm, Hissar, were studied.

The studies also included the comparison of efficiency of estimation of lactation yield of cows milk recorded systematicaly at intervals of 7, 14, 28 and 56 days relative to simple random sampling.

During the course of this year, the daily milk records of two more herds of cows were examined to supplement the findings already made. There were 36 Red Sindhi cows maintained at the National Dairy Research Institute. Bangalore and 38 Tharparkar cows at the Government Cattle Farm, Patna. In the former, the calves were weaned at birth and in the latter weaning was not practised.

Systematic sampling was two to four times as efficient as simple random sampling even with recording intervals of eight weeks. For shorter intervals of recording the efficiency was even greater.

The average percentage standard errors of the estimate of lactation yield of cows were of the same order for different herds for a given interval of recording.

The recording of milk yield at weekly intervals which would provide an estimate of the lactation yield of a cow with a precision corresponding to a standard error of 1.5 to 2 per cent was considered reasonably satisfactory for the purpose of rational supervision over daily milk recording by the research staff on a farm. When the records were taken at intervals of three days, the percentage standard error was expected to be decreased to about 0.7 to 0.9, corresponding to a margin of error less than 2 per cent.

The number of cows to be milk recorded was almost the same for a given herd size and level of precision whatever be the interval of recording, except for a small increase with eight weekly recording for low values of standard error.

The results of the studies were utilized in revising the plan for milk recording in the key village scheme so as to provide for reliable estimation of the average lactation performance of cows as well as that of the annual milk production in a key village block.

Preparation of Dairy Sanitizers for Use in Organised Village Milk Producing and Handling Units

The scheme commenced in June, 1955 with a view to testing the corporative, detergent and germicidal efficiency of different commonly available cleaning materials. Cleaning materials available in the Indian market continued to be examined for their detergent properties including general corrosive action on metals. Cetavalon and hyamine were found effective at a concentration of 1/5,000 while Cetyl pyridinium bromide was equally efficient at a much lower concentration of 1/50,000. A pyridinium compound prepared by the N.C.L., Poona was used in a concentration of 1/10,000 for achieving same results of the three types of cleaning powders compounded for use under different conditions ; the first group was found useful particularly under village conditions ; the second group in an aqueous solution either for soaking the utensils or scrubbing with a brush ; and the third served as detergent *cum* sanitizing agents for the cleaning and sterilization of milk utensils in one single operation.

Well cleaned utensils rinsed with solutions of different sanitizing compounds and milk cans sterilized by steaming were compared for the keeping quality of milk. In the case of good quality milk with a low initial bacterial count, the bacterial numbers in the milk held in chemically sterilized utensils were half to one-third of the numbers found in steam-sterilized utensils, which indicated a slight bacteriostatic influence of the sanitizing compounds. This was most marked in the case of hyamine and Cetyl pyridinium bromide. When the initial bacterial count of milk was very high, the above bacteriostatic effect was practically negligible. There was no appreciable effect on the flavour of milk held in any of the utensils.

ANIMAL NUTRITION

Regional studies

Three Regional Animal Nutrition Centres under auspices of the Council at Haringhata (West Bengal), Anand (Bombay) and Bangalore (Mysore) are engaged in a study of problems of animal nutrition pertaining to eastern, western and southern regions of the country.

A Northern Regional Station in the Punjab was also sanctioned, and will start functioning together with that on coastal region in the Third Five-Year Plan period.

Eastern region (Haringhata). At a centre established in Orissa it was found that typical rations for bullocks, lactating cows and dry cows mainly consisted of paddy straw, alone or in combination with

rice bran and *kulthi*. Some stock owners also included *mung bhoosa* in it for bullocks and milch cows. A ration including all the four feeding stuffs (paddy, straw, rice bran, *kulthi* and *mung bhoosa*) supplied entire DCP and TDN requirements of milch cow and most of the requirements of working bullocks. The other rations supplied contained DCP and TDN in a quantity far below the normal requirements of animals. However, it appeared that such rations were some what superior to typical rations on which the stock owners in West Bengal fed their animals. The carotencids and vitamin A ester content in the blood plasm of animals showed that they were able to make good a large part of the deficiency through the intakes of nutrients during stray grazing.

Other feeding stuffs used occasionally in the survey area were crushed paddy, *khesari*, gram, black gram, *baragudi* grain, *mung bhoosa*, *suannai* creeper, and leaves of mango, banyan, plum and Sheora trees.

Bullocks on an average worked for 4½ hours per day with a maximum of six hours in the monsoon, and 3½ hours in winter and summer seasons. Somewhat larger amount of *kulthi* was fed during the monsoon season to partly compensate for the extra working hours. The calculated body-weights from length and girth measurements were found to be 449 pounds and 325 pounds for bullocks and cows, respectively. The average daily milk yield by cows was found to be 1 pound per cow during a lactational period of 240 days, and the intercalving period of about 19 months.

Seasonal variations in the composition of concentrates and roughages appeared to be negligible (INSENSU). However, variations in protein and phosphorus contents in the composition of paddy straw were observed, the West Bengal and Orissa samples showing noticeable variations. Rice bran was found to be a heterogeneous mixture of bran and husk, and its protein content was very low (5.8 per cent). Pulses, *kulthi*, *khesari*, black gram, and *baragudi* grain, were good sources of protein, soluble carbohydrates and phosphorus. Field grasses showed seasonal variation in protein and phosphorus contents and these were positively correlated. The *suannai* creeper and tree leaves were good sources of protein and calcium. The ratio of Ca : P was rather high in tree leaves and *suannai* creeper, the maximum ratio (of 15.7) was observed in banyan leaves. The *suannai* creeper showed maximum copper contents.

Suitable rotational trials of fodder crops with cash crops, and of fodder crops only, were recommended on the basis of survey and experimental findings to augment the production of feeding stuffs.

The average haemoglobin content of blood collected from 112 field cattle during the Orissa survey came to be 9.3 gm./100 ml. blood. Morphological data for and chemical composition of blood and liver of goat, cattle and buffalo from West Bengal was studied. Field goats of West Bengal were found to be anaemic.

Western region (*Anand, Bombay*). The study of the chemical composition of grasses harvested from Banni area at different stages of growth was completed. A survey was started in the Gir breed

area of Saurashtra and this included a study of the grasslands of Saurashtra in collaboration with Dr. Albertson, T.C.M. Grassland Specialist.

At Banni, grasses harvested at different stages of growth did not reveal highly remarkable differences in their composition. Considering the yield output it appeared that the maximum output of nutrients could be obtained by first harvesting the grasses after 1½ to two months growth and then at monthly intervals ; it was thought desirable to allow grazing after about 1½ months growth and later adopt rotational grazing at monthly intervals.

Feeding practices followed in Saurashtra indicated that majority of animals were underfed in the monsoon, and overfed in winter. The average milk yield of cows, with calf suckling, was 5.6 ± 0.31 and of buffaloes 10.1 ± 0.37 pounds.

A study of the effect of harvesting gresses in Saurashtra at different stages on their composition and yield, involved harvesting in four different ways at two places, each having six replicates.

Stagewise composition of grasses indicated that when harvested at one month's growth they were more nutritive than when harvested at any other stage. The total yield of fodder by the first treatment carried in four stages was only 1,252 pounds per acre as compared to about 1,900 pounds by the other three methods. The nutrient yields per acre were computed from these data and they revealed that the second method carried in three stages, was the best. Though the yields of fodder by treatments 3 and 4 were as high as that by treatment 2, from the standpoint of crude protein and minerals they were much inferior. The grasses at Hirasar had better composition, but the total nutrient yield per acre at Valadhari was definitely more because of the thicker basal cover.

The haemoglobin content in the blood of healthy cows was 12.8 ± 0.28 gm./100ml. as against 13.8 ± 0.47 gm./100 ml. from that of calves.

The digestibility coefficients of grasses growing on boundaries of fields were: crude protein 57 per cent, other extract 51 per cent. crude fibre 79 per cent, and N.F.E. 56 per cent, the D.P. and T.D.N. being 4.79 and 56.2 per 100 of dry matter.

Sudden deaths of sheep and goats were reported in Nagpur. On investigation it was found that grazing of *hivar falli* (*Acacia leucophyla*) which contained more than 40 mgm. hydrocyanic acid per 100 gm. was mainly responsible. Moreover, the sulphur content was also abnormally high (2 per cent).

Extension work was carried out in Saurashtra along with survey work. Dissemination of information about proper feeding of cattle was done through agricultural and cattle shows and through farmers, gramsevaks, village level workers, etc., who visited the centre. Social and village level workers, who attended a refresher's course here, were provided with similar information.

Southern region (Bangalore). An animal nutrition survey was carried in Karimnagar, Telengana.

The cattle of the region were mostly Malvi breed cows and a non-descript breed of buffaloes. Cows were reared for male calves. Buffaloes were the only source of milk and yielded two to three pound milk per animal.

Jowar, maize, paddy and pulses were the important *kharif* crops, while paddy, maize and oilseeds were the *rabi* crops. There was acute scarcity of weeds and fodders in the area for the major part of the year due to lack of cultivation of the same. Grazing facilities were very meagre and limited to waste lands, Government lands known as *Ramnas* or *Kanchas* and patches of forest areas on the neighbouring hillocks. Occasionally, cattle were fed on green maize or *jowar* ; the latter collected from January to March had 6.34 to 12.02 per cent protein content, the highest being in January.

The dry fodders included paddy straw (*Oryza sativa*) different varieties of *jowar kadbi* (*Andropogon sorghum*) and maize *kadbi* (*Zea mays*) containing 3.42, 2.74 to 3.11 and 3.57 per cent protein, respectively. The common concentrates available in the area were groundnut cake (*Arachis hypogea*), *Til* or gingilly cake (*Sesamum indicum*), rice bran (*Oryza sativa*), horse gram (*Dolichos biflorus*) and *tur* gram puttu (*Cajanus cajan*) containing 47.70, 36.53, 11.73, 23.78 and 13.90 per cent protein, respectively.

An analysis of tree leaves of fodder value, during the scarcity season revealed their richness in nutrients.

Observations on dietary deficiency diseases indicated that the animals were underfed and in general were very small and stunted in growth. Average body-weights of cows, bullocks, calves, buffaloes, buffalo-bullocks and buffalo-calves were 318, 418, 119, 355, 532 and 97.5 pounds respectively. The ha-emoglobin content of cattle blood was 7.37, 7.50, 7.67, 8.05 and 8.08 per cent, respectively.

One hundred and fifty samples of feeds and fodders, 28 samples of blood, 64 samples of faeces, sample of water and eight samples of soil were collected and are being analysed.

A clinical survey for deficiency diseases was undertaken in Palnad taluk of Guntur district. Twenty-six out of 320 animals (8.1 per cent) were found to be suffering from 'Loose incisors' disease. The cause of the diseases is being investigated.

Forty-four samples of blood from local butcheries were examined for haemoglobin and morphological constituents.

Trace Elements Scheme, I.V.R.I.

Studies on influence of trace elements on health and capacity of livestock in India continued at Indian Veterinary Research Institute, Izatnagar.

During the year under report, 43 sample-feeds collected from four farms and two villages in Orissa were analysed for their copper content. In dry roughages, the content of copper ranged from 3.6 ppm. in paddy straw from Cuttack to 12.5 ppm. in gram *bhoosa* sam-

ples from Orissa, Green non-leguminous feeds and silages had values ranging from 3.9 ppm. to 9.75 ppm. while berseem showed values between 14.2 and 27.0 ppm. Concentrates had values ranging from 5.44 ppm. in rice bran samples from the Cuttack farm to 24 ppm. in groundnut cake samples from the Bhanjanagar farm in Orissa. In all the farms visited the copper intake was greater than the minimum recommended dose of 6.3 mg. per 100 pounds body-weight in dry animals and 10.0 mg. per 100 pounds body-weight in milch stock. At Rewa, the intake was marginal for both the dry and milch stock, while at Durg it was marginal for the dry cattle only. However, at the farms at Raipur, Durg, Cuttack and Bhanjanagar, the intakes of copper were boosted through the inclusion of a mineral mixture fortified with trace minerals. At the Bilaspur farm also, the calculated value included 20 mg. of copper from mineral mixture, which was included seasonally to the concentrate mixture. In the absence of such a mixture in the ration, the intake of copper in the buffaloes in this farm would have been inadequate. This is perhaps the reason why the haemoglobin content of buffalo calves was found to be low at this farm. In Bhanjanagar farm, the haemoglobin content of calves was found to be only 8.2 gm./100 c.c. blood in spite of liberal provision of copper through the mineral mixture.

The intake of copper in the village animals at Nischinkoily, Orissa, was very inadequate as reflected by a low haemoglobin content in the blood of local animals. But the copper intake at Nuagaon village seemed to be adequate and the animals had quite a high haemoglobin content in their blood.

An examination of 53 samples of feeds from different farms and villages in Madhya Pradesh and Orissa revealed a high manganese content of all the feed samples, ranging from 36 ppm. in wheat *bhoosa* from Rewa to 738.4 ppm. in paddy straw samples at Cuttack. The daily intake of manganese at different farms and villages in Madhya Pradesh and Orissa was found to be much higher than the prescribed minimum of 38 mg. per 100 pounds body-weight in dry stock and 68 mg. per pound body-weight in milch animals. The intake of manganese from a ration containing paddy straw, as in Orissa farms and villages, was exceptionally high.

The haemoglobin content in buffaloe-calves was higher than that in cow-calves from Orissa farms. Comparatively in the farm the trace elements intake was kept adequate through proper administration of a mineral mixture, but as village animals did not receive such supplementation they showed mild anaemia. It was ascertained that an inadequate trace elements intake, particularly of copper, produced anaemic symptoms. It was surmised that anaemia due to copper deficiency might exist in different parts of India.

An examination of 19 blood samples from sterile cows showed a range from 71.54 and 100.72 microgram per 100 mg. of blood with an average value of 85.36 $\pm$ 1.78 micrograms in the value of their copper content. This average was well within the normal range, and copper deficiency could not be a cause of their sterility.

Twelve thyroid glands collected from different places in Madhya Pradesh were histo-pathologically studied and were found to be otherwise normal except that the acini were rather small in size. The cause of this strophy remains obscure.

Feeding trials were undertaken to examine the effect of graded doses of molybdenum copper metabolism.

The results obtained indicated a slight lowering of haemoglobin content of blood in the 10 mg. molybdenum group. The increase in body-weight of the molybdenum supplemented animals was silghtly less than that of the control group. The excretion of copper in urine was increased in the molybdenum-fed animals. The balance of coper in the animals also tended to be lower than in the control animals.

Manganese fed at the rate of 200 and 500 mg. per 100 pounds body-weight for one month seemed to affect body-weight increase and ha-emoglobin content of blood adversely.

Degeneration of Cattle in Humid Climates—I.V.R.I. (Calcutta, Hissar)

An investigation in the causes of inability of cattle to behave to grow normally when transferred to a humid tropical environment, was initiated in 1954 at the Indian Veterinary Research Institute with field units at Calcutta and Hissar.

During the year under report, the Hariana animals showed a higher rate of growth than the Bengal animals. The animals and their progeny gained weight, both on the Punjab and local Bengal diet. Body temperature and pulse rate records between the breed and feed groups remained same. The respiratory rate per minute was more in Bengal animals than Hariana animals at Calcutta. The highest body temperature, respiratory and pulse rates were observed in Hissar on control group animals. Body temperature and respiration rates were generally higher in summer than in the winter months.

Records of actual food intake showed that the dry matter consumption per 100 pounds body-weight of the Bengal type animals was more than Hariana animals ; that with the increase in age up to the end of the third year body-weight and size, and food intake per 100 pounds body-weight decreased, later a $\pm$ constant rate was maintained: and that in most cases the dry matter consumption was more from October to December than during the rest of the year. This year again the Bengal animals consumed more water per day for 100 pounds body-weight than the Hariana animals ; in majority of cases, water consumption was more from March to September (summer and rainy season) than in remaining months.

Both at Calcutta and Hissar, Hariana animals had higher haemoglobin concentration than the Bengal animals. The Punjab diet groups also showed higher haemoglobin concentration than their counterparts. The values recorded were 12.70, 10.24 and 9.79 for Hariana animals at Hissar, and Calcutta, and the Punjab animals, respectively. W.B.C. and R.B.C. count values had no particular trend in these groups of Bengal animals than the Hariana animals.

Breed teeds, or place factors did not cause any appreciable difference in the protein and non-protein nitrogen levels of blood serum in majority of cases. The Hariana animals at Calcutta and Hissar showed higher values in calcium and inorganic phosphorus whereas the latter constituent was higher in the Punjab diet group in majority of cases.

Faecal examination revealed that animals at Hissar were mostly free of parasitic infection. At Calcutta, parasitic infection (roundworms) and coccidial (cocysts) were less frequently found during the first two quarters than in the third quarter of this year.

On analysis it was found that the Bengal concentrate mixture contained higher crude protein and total ash and lower ether extract, whereas total carbohydrate did not show any appreciable difference between Punjab and Bengal concentrate mixture. The crude protein and total carbohydrates recorded higher figures in *jowar kadbi*, and the other extract and total ash were higher in paddy straw.

The Punjab diet groups gave better reproductive performance than the Bengal diet groups of the either breed. The average duration of pregnancy of each group was 286.7 and 286.0 days for Hariana and Bengal animals, respectively. This average was almost identical for all the feed and breed groups at Calcutta.

Only 19 cows had completed the first lactation during the year under report and another ten animals were under observation. Besides first calvings, 14 originally selected animals also calved for the second time during the year under report.

Waste Products as Cattle Feed

This scheme started functioning in Orissa in December, 1954 with the object of studying the palatability, digestibility and physiological response of the animals fed on such waste products as were already examined and found suitable in respect of their nutritional value, etc., and to find out the economics of feeding such products.

Tamarind seed. At Keonjhar farm the buffalo, cows in Group 'A' at 10 per cent tamarind seed level yielded 5,256 pounds of milk. Group 'B' at 20 per cent level yielded 6,031 pounds and Group 'C' (Control) yielded 4,085 pounds of milk. In the case of cows, the Group 'A' at 10 per cent level yielded 2,446 pounds, group 'B' at 20 per cent level yielded 1,915 pounds and the control yielded 2,227 pounds of milk. The total butter fat content of milk of buffalo cows in Group 'A' was 342.7 pounds, in Group 'B' 438 pounds and in Group 'C' 3,167 pounds ; whereas in the case of cows butter fat content of milk 100.7 pounds in Group 'A', 91 pounds in Group 'B' and 110.7 pounds in Group 'C'.

At Boudh Farm the Group 'A' animals on 10 per cent level yielded on an average 2,743.5 pounds of milk, Group 'B' at 20 per cent level yielded 2,681.5 pounds and the control produced 3,049.6 pounds of milk.

At Gamundi village centre Groups 'A' and 'B' fed on 10 per cent and 20 per cent tamarind seed mixtures (tamarind seed and *mohua* flower) yielded 1,038.7 pounds and 656.4 pounds of milk, respectively. The fat per cent of milk in this case was 4.2 in Group 'A' and 4.3 in Group 'B'.

Cassiatora seed. In Keonjhar Farm the Group 'A' cows fed on Cassiatora seed at 20 per cent level yielded 1,232, pounds of milk, Group 'B', at 40 per cent level produced 1,380 pounds of milk, and Group 'C' (control group) yielded 1,479 pounds of milk. The average production of milk per day in group 'A' was 1.9 pounds, in Group 'B' 2.1 pounds and in Group 'C' 2.2 pounds. The total butter content of milk produced in Group 'A' was 64·5 pounds, group 'B' 64.2 pounds and Group 'C' 69·8 pounds. The cow-calves in Group 'A' gained body weight by 241.2 per cent. Group 'B' gained body-weight by 164.2 per cent and the control by 250.8 per cent. In case of buffaloe calves the increase in body-weight in Group 'A' was 240.6 per cent., Group 'B' 198.9 per cent, and the controls 228.2 per cent. In cow-calves the cost per pound increase of weight in Group 'A' was 92 nP., in Group 'B' Rs. 1.05 and in Group 'C' Re. 1.00 whereas in buffalo-calves the cost per pound increase of weight worked out at 75 nP. in Group 'A', 82 nP in Group 'B' and 87 nP in Group 'C'.

At Gamundi village centre Group 'A' cows yielded 461.7 pounds, Group 'B' 500.3 pounds, and Group 'C' 502 pounds of milk with average butter fat per cent of 3.6 in Group 'A', 4.2 in Group 'B' and 4.2 in Group 'C'. The total butter fat content of milk in Group 'A' was 16.6 pounds, in Group 'B' 21.4 pounds and in Group 'C' 21.1 pounds.

The investigation carried out in young stock revealed that Group 'A' calves increased in body-weight by 106.9 per cent, Group 'B' by 92.8 per cent, and Group 'C' by 136 per cent.

At the Gudabhaga village centre, Group 'A' cows yielded 374.5 pounds of milk, Group 'B' 407.9 pounds of milk, and Group 'C' 497.6 pounds of milk. Six cows in Group 'A' accepted bulls out of which four calved. In Group 'B' two have calved. In Group 'C', three cows calved out of five served. It was seen that Group 'A' animals gained body-weight by 194.5 per cent, Group 'B' by 148.5 per cent and Group 'C' by 166.1 per cent.

The cost per pound of milk in Group 'A' worked out at Re. 0.45, in Group 'B' Re. 0.36 and in Group 'C' Re. 0.35. The cost per pound increase of the weight in Group 'A' was Rs. 1.42, in Group 'B' Rs. 1.55 and in Group 'C' Rs. 1.62.

Sal fruit. At Gamundi village centre, cattle were fed on 20 per cent *sal* fruit (Group A), 40 per cent *sal* fruit (Group B), and control no *sal* fruit (Group C). Group 'A' cows yielded 208 pounds of milk with fat percentage of 3.97 and butter fat content of 8.3 pounds. In the Group 'B' the milk yield was 207 pounds with 3.84 per cent fat and 8.0 pounds butter fat. In Group 'C' the yield was 194 pounds of milk with fat per cent of 3.98 and butter fat content of 7.8 pounds. In young stock. it was observed that Group 'A' calves increased in body-weight by 16.7 per cent, Group B by 21 per cent and Group 'C' by 18.4 per cent. The cost per pound of milk produced in Group 'A' milch cows, was 0.23, in Group 'B' Re. 0.19 and in Group 'C'

Re. 0.22. The cost per pound of butter fat content of milk worked out at Rs. 5·03 in Group 'A', Rs. 4·55 in Group 'B' and Rs. 5·50 in Group 'C'.

Mahua flower. These experiments were conducted at the Gudabhaga Village Centre. The total milk yield of in Group 'A' cows fed on 10 per cent *Mahua* flower feed mixture was 852.66 pounds in Group 'B' receiving 20 per cent of the milk yield was 843.92 pounds. It was noticed at the end of the feeding experiment that Group 'A' youngstock increased in body-weight by 211.5 per cent, Group 'B' by 217.4 per cent and Group 'C' animals by 223.6 per cent. The cost per pound of milk produced worked out at Re. 0.60 in Group 'A', Re. 0.65 in Group 'B' and Re. 0.74 in. Group 'C'. The cost per pound increased of live-weight in Group 'A' was Re. 0.85 in Group 'B' Re. 0.81 and in Group 'C' Re. 0.78.

Urea as a Protein Substitute (I.V.R.I.)

The object of the scheme started on March 1, 1957 is to study how far the knowledge gained abroad on the feeding of urea to ruminants could be applied with advantage in meeting the protein requirements of Indian cattle.

During the year under report, 25, eight to 12 months old male buffalo-calves were selected and divided into five groups of five each. The age and weight of each group was nearly the same. The first group was termed as control and the animals of this group were maintained on calf mixture and wheat *bhusa ad lib*. The rest were termed as experimental Groups I, II and III and they received urea supplementation at the rate of 10, 20 and 30 per cent of the digestible crude protein requirement, respectively. The fifth group (known as experimental Group IV) was maintained on 70 per cent digestible crude protein supplied solely by the calf mixture. The rations were made isocaloric by the addition of necessary amount of starch to the experimental groups and wheat *bhusa* was offered *ad lib* in all cases. This feeding arrangement will continue for another year. Data with regard to weighing of animals every week is being recorded.

A metabolic trial, seven months after the commencement of the experiment, revealed practically no difference in the digestibility coefficients of crude protein and other extract in the various groups. The digestibility coefficient of crude fibre in the II and III experimental groups was slightly less than that in control group. The animals of the five groups were found to be in positive balance with respect to introgen, calcium and phosphorus.

Physiological studies revealed that the inclusion of urea in the animal ration had no effect on the temperature, pulse and respiration rates per minute. Blood studies made on the various groups of experimental animals had shown that haemoglobin, cell volume, R.B.C.'s W.B.C.'s, total protein and non-protein nitrogen values did not differ much in the various groups.

Disadvantages of Paddy Straw as Cattle Feed (I.V.R.I.)

The scheme was initiated in 1954 with object of studying the disadvantages of paddy straw as a cattle feed, and to develop methods for the improvement of paddy straw rations. During the year under report, factors responsible for the quality of paddy straw as roughage

and the effects of feeding improved paddy straw rations on growth and milk production were studied. An evaluation of the effects of water washing of paddy straw and of supplementation of rations based on untreated or water washed paddy straw with calcium salts or a trace mineral mixture was done. Water washing of paddy straw resulted in a reduction in the content of total ash, crude protein, crude fat, phosphorus, potassium and oxalates, and in an increase in calcium and crude fibre. Calcium balance was negative on the untreated paddy straw ration, even when it was supplemented with up to ½ ounce calcium carbonate on an equivalent quality of calcium chloride. No effect of trace mineral supplementation was apparent. A reduction in the urinary volume and alkali exertion was noticed on feeding washed straw rations. The data of digestibility co-efficients did not seem to indicate any definite trend as regards the effect of supplementation and water washing.

A metabolism experiment on 12 Kumaoni bullocks for a determination of a comparative value of calcium carbonate (one ounce, *i.e.*, 28 gm.) and bonemeal (45 gm.) as supplement to an untreated paddy straw ration revealed that bonemeal was superior to calcium carbonate as a supplement. In this experiment, controlled feeding of paddy straw and oil-cake was practised.

A new experiment involving *ad lib,* feeding of paddy straw was undertaken to assess the supplementing effect of one ounce and two ounces of calcium cabonate.

HIDES AND SKINS

Manufacture of Chrome Retan Leather

The scheme is in operation since 1954.

During the year under report, research work was undertaken for determining reasons of crackiness in Chrome Retan Leather grain during retanning, and it was found that excess fixing of vegetable tanning on the grain surface, defective fat liquoring and increased amount of water solubles, were the causes of crackiness. While use of anionic chrome liquor over catonic chromed leather before retanning and proper choice of vegetable tanning material and suitable fat liquors removed the defect.

Improvement of Quality of Shoe Upper and Industrial Leather—Manufactured by Mineral Tannage

This scheme is in operation since 1954 at the Central Leather Research Institute, Madras. During the year under report, chrome liquors were prepared by using sucrose glycerol and molasses. Tanning tests on pelt pieces and hide powders using chrome liquors strengthened with glucose, sucrose, glycerol, glycollic acid, lactic, oxaylic and formic acids were carried out. These tests indicated that addition of sucroses and glycollic acid strengthened liquors which had an improving effect on the quality of the leather, but use of larger quantities of formic acid was found to adversely affect fixation of chromium. A feature universally present in all leathers so treated was lack of a tightness of grain.

Manufacture of Fat Liquors for Leather Production from Indigenous Raw Materials

This scheme is working since the 20th February, 1954. Manufacturing fat liquors from Indian oils to make the Indian tanning industry self-sufficient in respect of these essential treatment materials was aimed at. For manufacturing oils like *neem, mohua, pisa* and *brahmadand* seed and also sardine fish oil, available commercially, were taken up for investigation during the year under report. Their physical characteristics and chemical constants were determined. Sardine fish oil obtained from various parties were found to contain considerable, 15 to 25 per cent, quantities of mucilaginous and gummy matters, and they were found to have wide, varying characteristics such as acid value, iodine value, soap value, etc. Hence, refining of sardine fish oil was taken up for processing an oil, starting from various other oils and then standardised the sulphation process. *Pungam*, tobacco, rice bran, cotton seed, *neem* and Neatsfoot oils were sulphated and encouraging results obtained.

Manufacture of Leather Boards from Tannery Waste Materials like Leather Shavings and Cuttings

The object of the scheme is to determine suitable methods of making leather boards of sufficient thickness and strength from tannery waste materials like leather shavings and cuttings so that they may be used for insoles and stiffness required in shoe industry.

During the year under report, investigations on using chrome leather wastes were conducted and it was observed that two parts of vegetable and one part of chrome leather waste by weight gave good results.

Further, too long or too short fibre length affected the texture of the final board. Attempts were made to retain the boards with chrome liquor and leather separately, but no change was noticed in physical properties. The flexibility and pliability of boards could be increased by adding extra amount of either latex or sulphated *pungam* oil.

Experiments on various fillers in the manufacture of boards gave different results regarding rigidity, softness, resistance and other physical properties. Resin on addition was found to improve water resistance of the boards while addition of calcium gave stiffness.

Research conducted on the effect of temperature and pressure in the manufacture of leather boards revealed that increase in temperature had effect while increase in the pressure gave extra hardness, tensileness and tear and bursting strength to the boards.

Pilot plant work was taken up and encouraging results were noticed.

PISCICULTURE

Processing of Inedible or Unpopular Fish

The scheme is in operation since October, 1954 at the College of Engineering and Technology, Jadavpur, Calcutta, with the object of finding out the reasons, chemical or otherwise, of the supposed

inedibility of some varieties of sea fish and to evolve methods of removing such causes, and also to produce economic products out of the protein contained in the tissues of such fish.

Studies conducted on relative absorption behaviour of carbon, Bentonite and Kieselgur from shark tissues of hydrolysate revealed that the ratio of amino-nitrogen to total nitrogen in protein hydrolysate was 0.585.

Work on preparation of the samples of neutralised shark tissue hydrolysate was undertaken by using sulphuric acid and also hydrochloric acid. It was seen that the heat developed during purging had relation with amino-acids retained, which depended on the amount of ion exchange resin. Further investigations revealed that the hydrochloride acid process was economical as compared to hydrolysing with sulphuric acid.

APICULTURE

Regional Bee Research Station, Coimbatore

This scheme started from December, 1951. An investigation on the possibility of improving the honey-yielding capacity of Indian bee (*Apis indica*) by selective breeding, and also to study certain fundamental as well as practical aspects of bee-keeping was envisaged. During the year under report, raising of pedigreed queens from two leading colonies was continued. Further observations were made on the influence of weather on nectar secretion and its concentration. Among the flowers studied, drumstick was found to be a dependable source of nectar for the bees as they survived on this even in the lean periods. In this flower the concentration of nectar varied from 16.1 to 50.8 per cent.

Work on various races of bees with reference to their taxonomy and biometry were carried out and it was seen that the characters like wing length, glossa length, cubital index had significant influence on honey-yielding capacity of colonies.

Investigations and pollen substitutes were conducted and it was found that breed rearing activity of bees depended more on seasonal activity than on the availability of fresh or stored pollen or on the substitutes provided.

Work on swarm prevention was carried out and it was noticed that interchanging method gave very promising results.

Chapter IV

STATISTICAL RESEARCH

ADVISORY WORK

The Statistical Wing of the Council continued its advisory work relating to the design of agricultural and animal husbandry experiments, and the interpretation of their results, examination of technical programme and annual reports of the Council's schemes and the scrutiny of statistical papers received for publication in the Council's journals. A number of statistical enquiries received from the Food and Agricultural Organisation of the United Nations, the Central Government, State Governments, Commodity Committees and other Institutions were also dealt with during the period under report.

TRAINING

The post-graduate training courses in Agricultural Statistics continued to be conducted by the Council. Seven out of the eight students who had successfully completed their first year Diploma Course were admitted to the Diploma second year Course and eight students joined first year of the Diploma Course. All the seven candidates pursuing the second year of the Diploma Course are in receipt of fellowships, five receiving a fellowship of Rs. 200 per month, and the remaining two a fellowship of Rs. 150 per month each. These students worked on the following problems :

1. Generalization of Stair-case designs.
2. Analysis of Rotational Experiments.
3. Amount of heterozygosity in cross-fertilized and self-fertilized populations.
4. Successive Sampling in multi-stage designs.
5. Study of relative efficiencies of designs, applied in A. H. experimentations.
6. Study of Production Functions for Milk yield data.
7. Power of two sided Non-parametric tests.

In addition, there are two research fellows working for their Ph. D. on (a) 'Tolerance limits in Distribution Theory' and (b) 'Some Models in Stochastic process'. Each received a fellowship of Rs. 200 plus the usual allowances.

Out of the eight candidates admitted to the first year Diploma Course this year, six were awarded the junior fellowship of Rs. 150 per month, each for a period of one year on the basis of the results of the 'Admission and Fellowship tests' held in July 1958. Twenty-two students deputed by the various State Governments, Central Research Institutes and other recognised institutions, were admitted to the Certificate Course. Out of these, seven students joined the Certificate Course and the remaining 15 the Senior Certificate

Course. Later on four out of the seven students of the Junior Certificate Course continued their studies as desired by their State Governments or Central Institutes for the Senior Certificate Course.

Eight candidates were declared eligible for the award of Diploma in Agricultural Statistics during the year 1958. Nine candidates of the Senior Certificate Course and seven candidates of the Junior Certificate Course were declared successful on the basis of the examinations held in June, 1958, and December, 1958, respectively.

Statistical courses to the students of the Post-graduate School in Agriculture established at the Indian Agricultural Research Institute are being given by the Statistical Wing of the Council. The first batch of the students of the post-graduate school was given the first course in experimental statistics at the Council during the Trimester February—May, 1959. The Assistant Professor of Statistics of the Indian Agricultural Research Institute, and the Statistician, Indian Agricultural Research Institute, were helping the officers of the Statistical Wing of the Council for the efficient conduct of the training.

Foreign Trainees at the Statistical Wing

Mr. Md. Bedawai, an official of the Sudanese Government joined the Council in July 1958, under the expanded Technical Assistance Programme of the F. A. O. to undergo training for a period of one year in sampling techniques in surveys, designs, and analysis of agricultural experiments. Mr. Hani N. Ghanma of Jordan who was deputed by the F. A. O. was undergoing training in sample surveys and agricultural statistics left the Council in July, 1958 after completing two year's training. Mr. Slamat Sudir Dogo, an official of the Indonesian Government who was deputed by the F. A. O. to undergo training in sample survey techniques for a period of one year left the Council in July 1958 after the completion of his training. Mr. Md. Hassan Taher Lashin of Egypt who joined the Council in May 1958, as a fellow under the expanded Technical Assistance Programme of the F. A. O. to undergo training for a period of four months in sampling methods for collection and compilation of fishery statistics left for Japan in end of July 1958. He again joined the Council in January 1959 and completed his training programme. Mr. Lee Yoke Heng from Malaya undergoing training at the International Statistical Educational Centre, Calcutta also underwent training at the council for a period of three months.

Since first-hand experience of planning, organising and conducting the field work of surveys for the collection of agricultural data form a part of the training programme, the students of the senior certificate course and the First year Diploma Course were desired to undertake a sample survey for the estimation of production of wheat at the Central Mechanised Farm, Suratgarh, Rajasthan in the month of April-May, 1958. The students of the second year Diploma Course carried out a similar survey during October-November, 1958 for the estimation of total production of paddy, *jowar* and *bajra* at the same farm. A number of educational tours were also undertaken. The first year Diploma Course students were taken to the Government Agricultural Farm, Himayatsagar, Hyderabad,

Central Rice Research Institute, Cuttack, Central Potato Research Institute, Patna, Agricultural Research Institute, Naini (Allahabad) and the Indian Veterinary Research Institute, Izatnagar. The junior and the senior Certificate Course students visited the Agricultural Research Institute, Anand, Sheep Breeding Station, Poona, Aarey Milk Colony, Bombay and the Agricultural Research Institute, Naini, Allahabad. At all these places the students were acquainted with the various aspects of research in progress and their statistical implications. The students of the training courses were taken to the Indian Agricultural Research Institute and its farms occasionally to get them acquainted with the research in progress and with the layout and conduct of field experiments of the various crops. They also received training in official statistics for about a fortnight in different sections of the Directorate of Economics and Statistics, Ministry of Agriculture, New Delhi.

In furtherance of the Council's programme of promoting greater use of the modern science of statistics in agricultural research a short term seminar course in Statistical Methods was conducted by the Statistical Wing of the Council in July, 1958 for the benefit of the Senior Agricultural Research Officers of the different States and Research Institutions. This was the second one in the series of such seminar courses planned by the Council. The course extended over a period of two weeks and included discussions on selected subjects of mutual interest, besides about 20 lectures on topics relating to Design of Experiments, Sample Surveys and Analysis of observational data with special reference to the recent developments in statistical techniques available for planning experimental programmes. Sixteen senior research officers participated in the course.

About 25 seminars on the subject of current statistical interest and on investigations in progress at the Statistical Wing of the Council were held. Members of the staff, students and a number of eminent statisticians participated in the seminar programme. A special seminar on 'Some recent advances in the construction of symmetrical designs' was held at the Statistical Wing of the Council in March, 1959. Messrs M. N. Das and J. N. Srivastava of the Council were the main speakers. Dr. K. R. Nair, Statistician, Forest Research Institute, Dehra Dun and Dr. K. Kishen, Chief Statistician, Department of Agriculture U.P., took part in the discussion. The seminar was attended by a large number of statisticians from the Centre and the Central Institutes.

At the invitation of the Indian Council of Agricultural Research, Dr. K. Kishen, Chief Statistician, Agriculture Department, Uttar Pradesh gave a series of ten lectures on 'Recent Developments in Design of Experiments' at the Statistical Wing of the Council during the month of November, 1958. Besides these, for the benefit of the students of the training courses a number of lectures by the senior officers from the Indian Agricultural Research Institute, Indian Veterinary Research Institute, Izatnagar were arranged. Dr. O. P. Gautam, Dr. A. B. Joshi, Dr. T. D. Biswas, Dr. N. C. Panth, Dr. N. G. Ramdas Menon and Dr. R. Prasad from Indian Agricultural Research Institute, and Dr. V. Mahadevan and Dr. M. R. Dhanda were among those who delivered these lectures.

A large number of students from other Institutions visited the Statistical Wing of the Council during the year under report and were acquainted with the training and research work of the Council. These included statistical officers undergoing training at the Central Statistical Organisation, New Delhi, delegates to the Mathematical Seminar Organised by the Delhi University delegates to the Statistical Section of the 46th Indian Science Congress, Senior M. Sc. (Statistics) students of the Andhra University and the students from the Indian Statistical Institute, Calcutta.

The International Training Centre in Fisheries Statistics

The International Training Centre in Fisheries Statistics under the joint aegis of the Government of India and the Food & Agriculture Organisation of United Nations, was inaugurated by the Minister for Civil Supplies, Housing and Fisheries, Bombay State on the 13th February, 1959 to 13th April, 1959 at Taraporewalla Aquarium, Bombay. Twenty-two trainees from eight countries, namely, Ceylon, India, Indonesia, Japan, Malaya, Philippines, Thailand and Viet-Nam participated at the centre. Dr. M. S. Randhawa, Vice-President, Indian Council of Agricultural Research acted as Director for the centre and Dr. V. G. Panse as one of the associate Directors. The training programme included *inter alia* lectures, laboratory practicals and field trips to the coastal areas of Bombay and Kerala States. Experts in fisheries' statistics from foreign countries as well as official of the Institute of Agricultural Research Statistics (Indian Council of Agricultural Research), and other senior officers of the Ministry concerned with fisheries delivered lectures to the trainees.

Standardisation of Experiments on Horticultural Crops

The Statistical Wing of the Council initiated studies on the optimum size and shape of plots and blocks, efficiency of different designs, etc., from uniformity-trial as well as actual experimental data. Uniformity-trial data on pepper for about 1,000 standards per garden was collected, during 1956 and 1957, from two gardens located in two different villages of Mysore and Kerala. An examination of the optimum size and shape of plots, blocks and efficiency of confounding showed that the optimum size of plot, when no guard row was provided was found to be a single standard per plot, if the cost of experimentation is taken as proportionate to the number of standards. When single or double guards were provided, as in the case of manurial, spacing trials, etc., it was found that plot sizes of four to six standards were the optimum; but even for a wider range of plot sizes, there was no consistent or appreciable change in efficiency. The shape of plot was not found to affect the variability appreciably.

In large and oblong plots compact blocks were generally found more efficient.

The efficiency of confounded designs of 2^5, 2^4 and 2^3 factorials in blocks of eight or four plots was examined and it was found that with large plots, confounding, particularly in four plot blocks resulted in a substantial gain in information, but with small plots the gain due to confounding was small. The number of proper standards required to estimate treatment differences with specified level of accuracy were also calculated for different plot sizes.

A statistical analysis of the uniformity trials, data over a number of years on mango and citrus fruits in experiments at the Kodur fruit research station is under examination.

ANALYSIS OF LONG TERM EXPERIMENTS

Data of three experiments on paddy crop at Cuttack and two experiments on the sugarcane crop, one each at Shahjahanpur and Padegaon, respectively, were examined.

The Cuttack experiments were conducted for five to nine years. Significant responses were obtained to the application of nitrogen in the form of ammonium sulphate and to organic manures, compost, green manure and groundnut cake. The response to 40 pounds N per acre in the form of compost was of the same order as to 20 pounds N per acre in the form of ammonium sulphate in two of the experiments. In the third experiment, where the responses were low responses to the two manures were of the same order. The application of nitrogen decreased in successive years in two of the experiments. Application of compost resulted in a mean annual gain of 0.4 to 0.5 maunds acre over no compost plots.

The treatments for the long term experiment on sugarcane at Shahjahanpur consisted of the application of nitrogen, phosphorus and potash, each at three levels alone and in combinations. The rotation followed was sugarcane-fallow-sugarcane. Data for the first few years of experimentation have been examined. Significant responses to the application of nitrogen were obtained in all years. There was a generally falling trend in yields of all plots in successive years, the deterioration being more pronounced in the nitrogen treated plots Application of phosphorus and potash did not retard this deterioration. Application of the green manure crop, *senai*, subsequently, was found to raise the cane yields. Examination of soil analysis data indicated low values of pH, CaO, total exchangeable bases and exchangeable calcium in the nitrogen treated plots which were raised by the application of green manure subsequently. It was concluded that the decrease in yield in successive years was due to decrease in calcium, following the repeated application of ammonium sulphate.

In the Padegaon experiment, where nitrogen in the form of ammonium sulphate and groundnut cake alone, and in combination, was tried in the presence and absence of compost, high responses were obtained with nitrogen. Compost also gave a moderate response. The response was greater for groundnut cake as compared to ammonium sulphate. There was deterioration in the yield of all plots. The deterioration was higher in the nitrogen-treated plots and was reduced in the initial stages by the application of compost, but this favourable effect could not be maintained over a long period. Subsequently, when the three nutrients N, P and K were applied together, the yield level increased, the response to NPK being higher than that the due to compost.

FERTILIZER DEMONSTRATION ON CULTIVATORS' FIELDS

The all-Indian scheme of Fertilizer Demonstrations on cultivators fields was initiated in collaboration with the Technical Co-operation Mission of the U. S. A. in March, 1954 with a view to making the

cultivators fertilizer-minded and to popularise among them the use of such inorganic fertilizers as urea, ammonium sulphate, ammonium sulphate-nitrate, superphosphate and mixed fertilizer. During the year, data of about 5,000 demonstrations conducted in *rabi* 1956-57 and a supplementary note giving the results of 850 demonstration conducted in Uttar Pradesh in *rabi* 1954-55 were statistically examined.

The results of *rabi* 1956-57 were based on 1,378 demonstrations on wheat and 3,477 demonstrations on second crop paddy conducted during the season. Application of 30 pounds N/acre to the wheat crop gave an average response of about two maunds acre in Bombay, Madhya Pradesh and Himachal Pradesh. The response of wheat to the same dose of nitrogen was 2.7 maunds/acre at Delhi.

The response of wheat to 215 pounds of mixed fertilizer (14 N : 7P) per acre was two maunds/acre in Bombay State.

A sizable number of demonstrations for obtaining the response of wheat to phosphorus was available only from Amreli, Kutch and Sholapur districts of Bombay State. Response to the application of 20 pounds P_2O_5/acre was generally low, being about one maund/acre except in Kutch district where the response was moderate, being three maunds/acre.

The average response of paddy (second crop) to the application of 30 pounds N/acre was six maunds/acre; and it was very high (11 maunds/acre) for Mysore.

The average response of paddy to 215 pounds of mixed fertilizer per acre varied from 4.5 to 5.5 maunds/acre, the mean response being five maunds/acre.

ECONOMICS OF MANURING

The monetary gain due to manuring varies with the dose of fertilizer, the response obtained, the cost of the fertilizer and the prices received by the cultivator for the crop. The profits have been worked out at a uniform price of Rs. 12 per maund of paddy and Rs. 16 per maund of wheat for all the States.

The profits from the application of 30 pounds N/acre to wheat were 69 per cent and 31 per cent over the investment on fertilizers in the States of Delhi and Bombay, respectively. The profit from the application of 215 pounds of fertilizer mixture to wheat in Delhi State was of the order of 85 per cent over the investment on mixed fertilizer.

The application of 30 pounds N/acre to paddy provided the highest profit in Mysore State the net profit being 39 per cent on the investment. Profits of about 130 per cent over the investment on the purchase of fertilizers were observed in Madras and Kerala States. The application of fertilizer mixture yielded profits ranging from 100 per cent to 170 per cent over the investment on fertilizer in the different States.

Data pertaining to *rabi* 1954-55 demonstrations on wheat crop conducted in Rampur, Sitapur, Bareilly, Mathura, Allahabad, Kheri, Etah and Etawah districts of Uttar Pradesh showed that an average

response to the application of 30 pounds /acre was about three maunds acre ; moderate to good response were obtained in all the districts. The average additional response to 30 pounds P_2O_5/acre over 30 pounds N/acre was 2.5 maunds/acre and ranged from 1.6 to 4.6 maunds per acre. Mixed fertilizer (10 N: 8P) at the rate of 300 and 450 pounds per acre was tried in most of the districts. The average response to 300 pounds of mixed fertilizer per acre was three maunds/ acre. Increase in the amount of mixture to 450 pounds per acre resulted in an average increase of two maunds/acre.

Data pertaining to the demonstrations conducted in different States during *kharif*, 1957-58 and in Uttar Pradesh in *kharif* 1955-56 are under examination.

AGRONOMIC EXPERIMENTAL SCHEMES

The co-ordinated Agronomic Experiments Scheme is an extension of the T. C. M. 'Fertilizer Use Project' and is included under the Second Five Year Plan. It includes complex agronomic experiments at the model agronomic centres and simple trials on cultivators' fields.

Nine types of complex factorial experiments on manurial, cultural, rotational and irrigational problems are being conducted at 30 centres spread over the country on blocks of 15 acres taken on lease from the cultivators. Scientific information on the individual, aggregate and cumulative effects of numerous growth factors under different conditions of soil, climate and cropping are being collected.

During the year 1957-58 and 1958-59, 151 and 179 experiments respectively, were conducted at 30 centres. Of 59 experiments conducted at 17 centres in *rabi* 1956-57, 32 experiments were on the wheat crop and these were analysed. Response to nitrogen at 20 pounds/acre varied from 1.8 to 3.7 maunds/acre at the different centres. A very higher response of 7.6 and 5.5 maunds/acre as obtained at Obedullaganj and Varanasi centres, respectively. The response was low at Pusa and Umaral centres. Increase in the dose of nitrogen from 20 pounds to 40 pounds/acre gave an additional response off the order of 0·5 to 2 maunds/acre. At Obedullaganj centre the additional response was as high as 3.2 maunds/acre.

Average response to phosphorus at 20 pounds/acre was 1.1 maunds/acre. A very high response of 7.6 maunds/acre was obtained at Pura centre. Increase in dose from 20 pounds to 40 pounds/acre did not produce any appreciable increase in response except at Powerkheda and Pura where the additional responses of 4.8 and 2.1 maunds/acre, respectively, were obtained. Potash did not show response.

The response to the combined application of nitrogen and phosphorus was of the same order as the sum of the responses of the two constituents when applied alone. The same trend was evident for the higher level of application of the two nutrients.

Application of nitrogen in the form of ammonium sulphate, urea or ammonium nitrate at different times, *viz.*, at sowing and at first irrigation either full or split doses did not produce any significant differences in response. There was no consistent

and significant difference in the performance of the three nitrogenous fertilizers; but in general urea was slightly superior to the other two fertilizers.

Average responses to the three different methods of placing the phosphatic fertilizers, *viz.*, broadcast, 2½ inches below seed and band placement were of the same order. Ammonium phosphate and superphosphate, the two forms of phosphatic fertilizers tried, did not show any significant difference in response.

Sowing of wheat 10 to 15 days later than the normal sowing date resulted in lower yields compared to normal sowing and sowing 10 to 15 days before normal date. There was no difference in the yields between the later two times of sowing.

There was no significant difference among the three seed rates, *viz.*, 50 pounds, 70 pounds and 80 pounds/acre at any of the centres.

SIMPLE FERTILIZER TRIALS ON CULTIVATORS' FIELDS

The object of this co-ordinated scheme is to estimate the responses to nitrogenous, phosphatic and potassic fertilizers, and the optimum doses of each of these to be applied in a given tract so that suitable manurial schedules may be drawn up for the benefit of the cultivators. The relative values of different sources of nitrogen and of phosphate will also be studied. During the Second Five Year Plan period, about 200 districts which have a normal rainfall of about 35 inches or above, or otherwise possess adequate irrigation facilities are proposed to be covered. Each district will be divided into four homogenous zones and in each zone, 31 experiments are to be conducted on randomly selected fields of cultivators. These include eight experiments, on a *kharif* cereal, eight on a *rabi* cereal, eight on a cash crop, four on an oilseed and three on a legume crop. In the four important jute-growing States of Assam, Bihar, Orissa and West Bengal, experiments on jute will also be included.

The field staff appointed under the scheme in each State is imparted thorough training by a statistician of the Council and an Agronomist of the Indian Agricultural Research Institute, New Delhi. By the end of the year 1958-59, training of the field staff was completed for the States of Assam, Bihar, West Bengal, Orissa, Uttar Pradesh, Madhya Pradesh, Punjab, Rajasthan, Andhra Pradesh, Madras, Kerala and Mysore and the Union Territories of Himachal Pradesh and Delhi. About 4,800 experiments were conducted in the year under report in 87 districts distributed over Bihar, West Bengal, Orissa, Uttar Pradesh, Punjab, Rajasthan, Andhra Pradesh, Kerala, Mysore, Himachal Pradesh, Delhi and Madhya Pradesh.

THEORETICAL RESEARCH

National Index of Field Experiments

It was started in October, 1955 by the Council with the object of maintaining at a central place an up-to-date unified record of all agricultural field experiments carried out in this country on specially designed index cards and to undertake the preparation of

compendium of past experiments for the period 1935 to 1953 in continuation of a similar compendium prepared by Vaidyanathan in 1953.

The total number of experiments so far collected by the regional staff was 10,000 of which about 6,600 belonged to the period 1935-53, and the rest pertained to post-1953 experiments. The number of experiments reported to the Council is of the order of 7,800 of which about 5,000 belong to the pre-1954 period.

Since collection of data for the entire period 1935-53 was likely to involve delay, it was proposed to prepare initially a compendium of the experiments carried out during 1948-53. The total number of experiments carried out during this period is expected to be 6,500; of these about 4,800 experiments have already been collected.

Sampling of Dairy Milk Records for Estimating Lactation Yield of Cows

During the course of the year, additional data pertaining to the first lactation records of 36 Red Sindhi cows maintained at the National Dairy Research Institute, Bangalore, and 38 Tharparkar cows at Government Cattle Farm, Patna, were examined; this data on four herds collected studied last year was confirmed.

The unbiased estimate of the lactation yield of a cow calculated from the sample total and the biased estimate of the lactation yield obtained from the sample mean when compared with respect to their efficiencies showed that the two estimates were equally efficient for shorter intervals of recording such as one week and two weeks, and for assessing the average lactation yield of a group of cows as well. In practice, however, the use of unbiased estimates in both the situations was found convenient. An approximate method of obtaining the estimate of the variance of the average lactation yield of a group of cows was developed and it was found to be quite satisfactory for all practical purposes.

The results obtained helped to revise the plan for milk recording in the Key Village Scheme. For estimating the average lactation performance of cows as well as that of the annual milk production in a Key Village block it was found that the most satisfactory procedure would be to record the milk yield of three selected cows every day by the milk recorder and two cows by stockmen in each Key Village, each cow being recorded at intervals of eight weeks. The average lactation yield of the population of cows in the Key Village block would then be estimated with a standard error of less than 2 per cent, on an average. In this manner, 15 per cent of the milch animals could be recorded for milk.

STATISTICAL ANALYSIS

Indigenous Goat Breeding Scheme

The foundation stock is composed of the existing progeny of a herd of betal goats reared on the farm and purchased in 1928 from Gujranwala and Sialkot, and goats purchased from Batala in Gurdaspur district of the Punjab in 1939. These herds are referred to as the farm-bred herd and the purchased herd. During December, 1939 to March, 1957, seven generations of goats were available.

The total number of kids born was 3,914. The number of goats with at least one complete lactation record was 514. These gave a total of about 1,600 normal lactation records for study.

Mortality was high among the kids, about 25 per cent for those below one month of age and for female young stock between ages of one month to one year. It was due to the diseases gastritis and pneumonia which together accounted for 50 per cent of deaths.

The overall changes in the characters, lactation yield, yield per day of lactation and yield per day of kidding interval were almost parallel in both the farm-bred and purchased herds. There was a decrease in the value of the characters from the foundation stock to the first generation and from the first to the second. There was subsequently an increasing trend in the values up to the fifth generation which had averages slightly lower than those of the first.

For the goats of the farm-bred herd the averages for the fifth generation in the first lactation were 414 pounds for lactation yield, 1.86 pounds for yield per day of lactation and 1.11 pounds for yield per day of kidding interval. The corresponding averages for the goats of the purchased herds were 326 pounds, 1.54 pounds and 0.76 pounds, respectively.

In general, the bucks were poor transmitters in so far as milk yield was concerned. Bucks 437 and 628 were the only two which showed more than 20 per cent superiority above the herd average of 340 pounds.

The estimates of heritability based on first lactation yield for the two herds were 0.18 $\pm$0.18 (107 d.f.) and —0.13 + 0.18 (108 d.f.) showing that there was not much scope for improvement in regard to lactation yield. Those estimates for birth-weight were 0·19 $\pm$ 0:07 (1,195 d.f.) and—0.16$\pm$0.07 (1042 d.f.), respectively.

May-June was the best season for mating, and kidding took place in October-November. When the number of kiddings was the maximum, their mortality was low and their birth-weight higher.

Milk Composition Data

The data on fat content, solids-not-fat content and specific gravity in genuine samples of milk collected from Bihar, the Punjab and West Bengal were examined with a view to reviewing the quality standards for market milk. During the period under study, the analysis of the Punjab data was continued and that of Bengal data commenced. The salient features of the study are given below.

Punjab. The lower tolerance limits below which 1, 5 and 10 per cent of the sample values lie, were estimated for each season from raw data, normal approximation to the distribution, and appropriate Pearsonian curve. As in the case of Bihar the three sets of limits, corresponding to 10 per cent were close to one another.

A season-wise comparison showed that for percentage butterfat of cow milk, the tolerance limits for the summer season were lower than those for winter while for the other two characteristics,

the summer value exceeded those of winter. For buffalo samples the situation was exactly the reverse. A further study indicated the inadvisability of imposing the same standard for both seasons for cow milk.

Under the official standards prescribed for butter-fat percentage about 21 and 11 per cent of genuine samples of milk of individual animals would be rejected for cows and buffaloes, respectively, while for percentage solids-not-fat, the rejections would be 11 and 12 per cent, respectively, if milk of individual animals were sold separately.

West Bengal. The mean values for all the three characteristics were significantly higher for buffalo milk than those for cow milk. The percentage coefficient of variation was found to be 18 and 16, respectively, for butter-fat content of cow and buffalo milk, about one-fourth and one-third as much for percentage solids-not-fat and less than 0.2 per cent for specific gravity.

Seasonal variation and variation between city including suburbs and other areas was observed. However, morning and evening milk samples of cows and buffaloes did not differ significantly.

For percentage solids-not-fat of cow milk and percentage butter fat of buffalo milk the proportions of individual samples of genuine milk falling below standards were 11 per cent and 15 per cent, respectively, while in the remaining cases they were about 4 per cent.

Possibilities of using Milking Cows for Work

These investigations were carried out at the Indian Dairy Research Institute, Bangalore, and at the Indian Veterinary Research Institute, Izatnagar, under the auspices of the Council to determine to what an extent milking cows could be profitably used for draught purposes without imparing their milking capacity, health or reproductive performance. The scheme commenced at the Indian Dairy Research Institute in April, 1949 and terminated in March, 1955; that at the Indian Veterinary Research Institute started in April, 1953 and terminated in May, 1958. Ten pairs of Red Sindhi and 12 pairs of Hariana cows, respectively, were under observation in the two schemes, one cow in each pair chosen at random being put to work, which consisted generally of carting and ploughing, except for two months before calving and one month after calving, and the other being kept as control.

The average values for total milk yield, total butter fat and number of days in milk during the experimental period in the case of Red Sindhi working cows were 18,831 pounds, 992 pounds and 1,192 days, respectively, compared to 20,470 pounds, 1,048 pounds, and 1,348 days for the control group cows. The differences were insignificant. Lactation-wise results for these characters as well as for calving interval were not also significant. Working group of Hariana cows showed significant decreases in total milk

yield and butter-fat produce during the entire period of the scheme. The average values for total milk yield, butter-fat and the days in milk during a period of 1,151 days were 4,317 pounds, 195 pounds and 607 days, respectively, as compared with the average values of 6,637 pounds, 310 pounds, and 735 days, respectively, for the cows in the control group.

In the case of Red Sindhi cows the roughage which was fed *ad lib.* was of the same order for both the groups while on an average 1.2 pounds more concentrate was fed to working cows. The cost of feed per day amounted to Rs. 1.40 for a working cow and Rs. 1.24 for the other. In Hariana cows the control group cow had one pound more roughage per day on an average and two pounds less of concentrate mixture per day.

In both the breeds the average weights of the cows at calving in the two groups were similar, and so were the birth-weights of calves of either sex.

There were no significant differences in the percentage of services resulting in conception for the two groups in both the cases. However, for Red Sindhi working cows the percentage was 49 compared to 27 in the case of Hariana cows against 54 for Red Sindhi cows and 34 for Hariana cows in control groups.

From an economic point of view it appeared that the additional expenditure incurred on feeding cows at work and the loss resulting from the decrease in milk yield could be balanced by the outturn of work, provided in either breed the cow was at least 60 per cent as efficient as bullock at work.

Data regarding milk performance of the two groups of Red Sindhi cows though not significant indicated a decrease in the total amount of production of milk yield as well as butter-fat in the working cows in both the herds. The decrease was 8 per cent in total milk yield, and 5 per cent in total butter-fat in the Red Sindhi cows put to work whereas it was as much as 35 and 37 per cent, respectively, for the two characters in the Hariana cows.

Survey of Bacteriology-quality of Milk, Anand

The scheme started functioning at Anand in October, 1955. The statistical analysis of the data collected during October, 1955 to October 1957 and carried out at the Statistical Wing of the Council pertained to samples of raw milk from individual societies and to bulk milk at the union, both in the raw state and after pasteurisation and related to various tests carried out for determining the bacteriological quality of milk.

Raw Milk Samples from Individual Societies. The Statistical analysis revealed that the methylene blue reduction time, standard plate count and Resazurin one hour and ten minutes reading showed seasonal as well as daily variation. In the case of thermoduric count there was a significant variation only among seasons while acidity which remained almost constant, ranged between 0.201 to 0.1297, showed seasonal and daily variation interestingly while the standard

plate count went down from the first year to second year, thermoduric count increased. The quality of raw milk samples varied from season to season and during the same seasons in the two years. The mean values for M. B. R. time, standard plate count, thermoduric count, Resazurin one hour and ten minutes reading for various seasons and morning and evening ranged from 65 to 193 minutes, 4.51 to 12.65 millions, 7.63 to 27.81 thousands, 1.0 to 5.1 and 4.0 to 6:0 respectively.

Bulk Milk at the Union (raw). Raw milk samples taken at the start were of a superior quality than those taken at the end in respect of all characters at both the times of milking. Further, morning samples differed from evening samples : thus while the M. B. R. time varied from 77 to 171 minutes for morning samples taken at the start, it varied from 53 to 126 minutes for similar samples taken in the evening. Such differences were also found between the corresponding samples taken at the end. Slight deterioration in the course of bulking was also noted.

Bulk Milk at the Union (Pasteurised). Except in case of M. B. R. time for morning samples there was no material difference in the quality of pasteurised milk at the start and end. In general, morning samples were of a better quality than the evening samples. The average M. B. R. time for pasteurised samples was generally over five hours whereas it varied from one to three hours for raw milk samples. The standard plate count had a value of only eight to 43 thousand for pasteurised sample as compared with five to 16 millions in the case of raw milk.

Progress of work in the Rinderpest Eradication Scheme

The assessment was made from weekly returns received from the field staff working in the States of Bombay, Andhra Pradesh, Orissa, West Bengal, Bihar, Assam, Uttar Pradesh, the Punjab, Jammu and Kashmir, Himachal Pradesh, Rajasthan and Madhya Pradesh where the scheme was operating during 1958-59.

Animals vaccinated during the period 1-4-1958 to 31-12-1958 by the field staff, working under campaign amounted to 114 lakhs. An additional 22 lakh animals were reported to have been vaccinated by the same staff for which no returns were received. About 27 lakh vaccinations were also reported to have been carried out by the normal departmental staff in various States.

On an average, 128 doses of vaccine were used for vaccinating 100 animals, the wastage of vaccine being very high, particularly in Uttar Pradesh (157) and Jammu and Kashmir (143).

This wastage may be attributed to the large number of doses contained in each ampoule. The percentage of animals vaccinated in the villages visited averaged to 78.5, ranging from 54 in Assam to 93 in Orissa. The overall average number of vaccinations per individual per week worked out to 291, varying from 530 in the Punjab to 135 in Assam.

Cultivation Practices and Estimation of Area and Yield of Pepper Crop (1958-1959)

With a view to evolving a suitable sampling technique for collecting reliable data on cultivation practices and yield of pepper crop, pilot sample surveys were conducted by the Indian Council of Agricultural Research in the former States of Madras and Travancore-Cochin during the years 1954-55 to 1956-57. During 1956-57, the survey in Travancore-Cochin could not cover the pepper-growing districts of Malabar and South Kanara (transferred to Madras after reorganisation of States) and these were taken up during 1957-58. The plan of the survey was one of stratified multi-stage random sampling design where the pepper growing talukas were adopted as strata. A village, a pepper growing plot and a cluster of bearing trees were the units at the first, second and third stages of sampling. The field work of the scheme was entrusted to 20 *ad hoc* field investigators specially recruited for this purpose.

The technical guidance of the scheme is accorded by the Statistical Adviser of the Council and the statistical analysis of the data will be done at the headquarters of the Council.

Milk yield, Breeds and Management Practices and Bovines (1958-59)

The object is to evolve a suitable sampling technique for estimating annual milk production and collecting reliable data on various practices relating to the rearing and feeding of cattle and buffaloes in a tract. The Council undertook a series of pilot sampling investigations in the different animal husbandry regions of the country, covering a typical tract in each region in each year of the Second Five-Year Plan. The investigation started during 1956-57 in the Punjab State of the Northern region. The second during 1957-58 in the portion of Uttar Pradesh State falling in the Eastern region. During 1958-59, a similar investigation was commenced in the Gujarat and Saurashtra areas of Bombay State in the southern region. The plan of work adopted for Bombay State (1958-59) was analogous to that in Eastern Uttar Pradesh (1957-58) except that in Bombay State the talukas in the area were combined into homogenous groups consisting of one to three talukas, the basis of such grouping being determined by geographical contiguity and the number of bovines in each taluka as obtained in the 1956 livestock census. Out of 20 groups of talukas selected in the sample nine were kept constant throughout the period of field work in the year, while the remaining 11 were selected afresh for each season.

The field work of the survey in the Bombay State will terminate by the end of June, 1959.

A preliminary statistical analysis of data collected in Uttar Pradesh shows that in respect of cows in the rural area of the tract the estimated average daily milk yield per animal in milk varied from 1.19 pounds in winter to 1.73 pounds in rainy season, the estimate for summer being 1.56 pounds. The overall average for the year worked out to be 1:46 pounds. The estimate of average daily milk yield per buffalo in milk in the same area was 2.88 pounds in summer season,

4.53 pounds in rainy season and 4.48 pounds in the winter season, the overall average for the entire period being 4.09 pounds. In the urban area the average daily milk yield per cow in milk was 2.72 pounds in summer, 2.61 pounds in rainy season and 2.32 pounds in winter season, the overall average for the entire year being 2.51 pounds. In the case of buffaloes the average was obtained as 4.51 pounds in summer, 4.88 pounds in the rainy season and 5.08 pounds in the winter season and the overall average for the year was 4.88 pounds.

Estimating the Cost of Milk Production (Madras)

Testing of sampling technique for assessing the cost of milk production evolved by the council in different parts of the country where local conditions differ, was continued. Persently, the urban and suburban areas of Madras City and a rural area of Madras State were surveyed.

The detailed enquiry regarding factors pertaining to cost of production of milk commenced from 1st October, 1957 and will continue up to the end of November, 1959; 54 households selected at random and containing milch animals (called stables) in Madras city; 96 stables in 24 villages in the suburbs of Madras and another 96 stables in 24 villages in the rural area of Gudiyathan taluk of North Arcot district are being visited once each week by specially trained investigators for collecting the required data. Data on milk yield and feeds are collected by direct weighment and other items are collected through observation and enquiry.

The returns filled in by the field staff pertaining to the selected stables are being received at the Council for scrutiny, compilation and statistical analysis. During the period under review it was found that for the rainy season, the net cost per seer of cow milk including that of unpaid labour was 61 nP. in the urban area, 91 nP. in the suburban area and 32 nP. in the rural area. The corresponding estimated cost for buffalo milk in three areas was 69 nP., 68 nP., and 30 nP., respectively.

Feed formed the largest item of cost amounting to about 85 per cent, 80 per cent, and 60 per cent of the gross cost per seer of milk in the three areas, respectively.

The average milk yield in seers per milch cow in the three areas was 3.37, 0.52 and 0.83, respectively, against 2.64, 1.06 and 0.93 of corresponding milch buffalo.

The butter-fat content in cow milk was estimated to be 5 per cent in the urban area, 4.7 per cent in the suburban area and 5.5 per cent in rural area. In buffalo milk, the fat percentages in the three areas were 7.1, 6.9 and 7.1, respectively.

About 88.5 per cent of cow milk was sold in the urban area but only 41.1 per cent and 45.8 per cent were sold in the suburban and rural areas. The percentages of buffalo milk sold in these three areas were 91.9, 76.1 and 80.2 respectively.

AGRICULTURAL ECONOMICS

Agricultural economics schemes financed by the Indian Council of Agricultural Research were in operation at universities and research institutions.

A pilot study on non-farm employment was conducted by the Department of Economics, University of Bombay in Thana district of Bombay State to study the nature and extent of non-farm employment.

The study has revealed that the non-farm employment opportunities fall into three broad categories: (i) The non-farm employment afforded by industrial establishments in the cities and urban areas, which are perennial and are dependent on the availability of proper transport link with the villages; (ii) occupations like fishing, salt making and forestry; and (iii) village handicrafts and arts.

The report is proposed to be published as a research bulletin.

A scheme with the object of studying the agro-economic problems in the multipurpose Damodar River Valley Project areas was undertaken by Shri Kishan Kanungo of the Delhi School of Economics. The data were collected with the co-operation of the officials of the Damodar Valley Corporation and Governments of West Bengal and Bihar. It is observed that after the Damodar Valley Project is completed, it will provide protection from floods to the lives and properties of a population of nearly three millions. The areas which lay waste in the past due to fear of flood could now be utilised for the cultivation of valuable crops. The Project will create irrigation potentialities for about a million acres of land in the *kharif* season and about three lakh acres in the *rabi* season. The project will generate electricity to the tune of 3,44,000 k.w. and this will lead to the industrial development in the area. The report is being processed for publication.

A pilot survey to sudy the farm and non-farm employment in South Arcot district was undertaken by the Annamalai University. The report was considered by the Agricultural Economics Committee at its meeting held in March, 1959 and it was decided that the Sub-committee formed for examining the report on study of non-farm employed in Thana district should also examine this report with regard to its suitability for publication.

The findings of the enquiry show that maximum number of working days for male farm labour is 160 in the garden zones and the minimum is 112 in the dry zones. Women agricultural workers are still more unemployed securing on an average a maximum of 129 days of employment per year in the garden and 85 days in the dry zones. The fishermen form a unique group securing a maximum of 243 working days. The earnings of rural artisans and craftsmen vary from Rs. 374 in the sugarcane zones to Rs. 188 in the dry zones. Suggestions were made in the report how to avoid unemployment in the rural area.

A study of intensive cultural practices on the small holdings was taken by the Calcutta University with the object of determining as size of economic holding under intensive cultivation practices, which may provide full employment to common cultivators. The scheme has been taken for period of five years, from September, 1956. Nine cultivators' holdings were selected for collection of data on input and output of agricultural production and similar data were collected from three artificial holdings taken on the experimental farm for

comparison purposes. It was found that cost of cultivation and return vary with varying cropping patterns and from holding to holding. Profit was not directly proportional to the cost, thus indicating the effects of multiple factors of crop production. In proportion to cost, the return obtained appeared to be higher in *kharif* than in *rabi* cultivation. Labour exployment is better in *kharif* than during the *rabi*. From the results of the study it is indicated that with intensive cultivation practices, employment of labour can be profitably increased during the *rabi* season. During the year under report maximum incomes recorded per holding are Rs. 2,140 for five acres, Rs. 925 for three acres and Rs. 586 for 1·26 acres, respectively.

A pilot scheme on the method and practice of farm accounts was operated at seven centres. Work at six centres in Bombay, Madhya Pradesh and Hyderabad was done under the supervision and administrative control of the Director, Gokhale Institute of Politics and Economics. The report for the six centres prepared by the Gokhale Institute has already been approved by the Agricultural Economics Committee.

The work of the seventh centre in Uttar Pradesh was taken up during 1956-57 with the object of exploring the possibilities of popularising keeping of farm accounts by farmers. The scheme was operated in 33 villages. Out of 79 participants the record books maintained by 60 of them were found suitable for inclusion in the analysis of data. The proformas developed as a result of this enquiry for maintaining farm accounts will be published with the Report of the Scheme.

Chapter V

HIGHER AGRICULTURAL AND VETERINARY EDUCATION

To meet the increased demand for trained personnel required for the various agricultural development schemes, the Government of India provided financial assistance to State Governments for (i) setting up new agricultural and veterinary colleges, and (ii) expansion of training facilities in some of the existing colleges. Under this scheme, initiated in 1955, financial assistance to the extent of Rs. 1,95,13,475 as grant and Rs. 82,61,525 as loan was sanctioned to State Governments up to the end of the financial year 1957-58. During the year under report, a further commitment of Rs. 42 lakhs as grant and Rs. 14 lakhs as loan was made for starting two more veterinary colleges, one each at Bangalore and Nagpur from July, 1958. Due to this financial assistance the number of admissions for degree courses increased from 254 in 1953-54 to 3013 in 1958-59 in agricultural colleges and from 615 in 1953-54 to 1293 in 1958-59 in veterinary colleges. The target of 6,500 agricultural graduates and 3,000 veterinary graduates prescribed for the Second Five-Year Plan is likely to be fully achieved as a result of the above measure.

TWO-YEAR EMERGENCY SHORT COURSE IN VETERINARY SCIENCE

In order to meet the shortage of trained veterinary personnel required for the various development schemes during the Second Five-Year Plan, the Government of India provided financial assistance to the State Governments for running two-year emergency course in veterinary science. The target fixed for training of such personnel during the Plan period is 2,000. Three batches of 843, 667 and 501 trainees were admitted under the scheme during 1955, 1956 and 1957, respectively. Two batches of 635 and 430 trainees have already completed their training during 1957 and 1958, respectively. With the completion of the training of the third batch during 1959, the target of 2,000 prescribed for the above category of personnel will be substantially achieved.

CENTRAL GRANTS FOR POST-GRADUATE EDUCATION

Financial assistance was provided by the Centre for developing the following State Agricultural and Veterinary Colleges as centres of post-graduate education; Government Agriculture College, Ludhiana (Punjab) ; Agriculture College and Research Institute, Coimbatore (Madras) ; Agriculture College, Nagpur (Bombay) ; West Bengal State College of Agriculture, Haringhata, Veterinary College, Mathura (Uttar Pradesh) ; Veterinary College, Madras (Madras); Veterinary College, Patna (Bihar) ; and Veterinary College, Bombay (Bombay). Post-graduate courses were started at the Agricultural College, Coimbatore, and the Veterinary Colleges, Mathura and Madras during 1958. The courses at the Punjab and West Bengal Agricultural Colleges and the Bihar Veterinary Colleges are likely to start from the academic year of 1959.

AGRICULTURAL UNIVERSITY IN UTTAR PRADESH

Financial assistance is also being given to the Uttar Pradesh Government for establishing an Agricultural University at Rudrapur on the pattern of Land Grant Colleges in U.S.A. The University will comprise the Colleges of (i) Agriculture, (ii) Agricultural Engineering and Technology, (iii) Veterinary Science, and (iv) Home Science. It will be located on the State Farm, Terai, which will serve as a laboratory for imparting practical training to the students. Necessary legislation for establishing the University was enacted by the State Government during the year under report and it deputed three officers to U.S.A. to study the administrative pattern, curricular and building designs, etc., of the American Land Grant Colleges. The three officers have returned and are engaged on a plan for the proposed university. The university is expected to function from the academic year 1960.

Short-term Refresher Courses at the Central Drug Research Institute, Lucknow

During the year under report, a refresher course in Pharmacology was held with a view to familiarizing teachers in veterinary colleges with the latest developments in Pharmacology. Ten Professors and lecturers from all over the country attended the course.

INTER-INSTITUTIONAL ARRANGEMENT WITH FIVE LAND GRANT UNIVERSITIES OF U.S.A.

This was initiated in 1955 under the Indo-U.S. Technical Aid Programme. Five Land Grant Universities of U. S. A. are co-operating with 45 Indian Institutions in the field of agricultural education and research by providing following assistance :

1. services of experienced American personnel for teaching and advisory work in India ;

2. advanced training to Indian personnel at the American Universities ; and

3. supply of laboratory equipment and books not ordinarily available in India to the co-operating Indian Institutions.

This programme, intended to improve the standards of teaching and research in the Agricultural and Veterinary Colleges in India, has worked very satisfactorily and a number of improvements in the methods of teaching and research have been brought about in the participating Indian Institutions. On an average 25 Americans worked with the participating Indian Institutions during the year under report. So far 134 Indian staff members left for advanced training in U. S. A. and 58 have already returned. The total value of the laboratory equipment and books supplied to the Indian Institutions up to the end of March, 1959, amounts to about Rs. 45 lakhs.

AGRICULTURAL EDUCATION

The third session of the Indian Council of Agricultural Education was held at Bangalore from August 23 to 30, 1958. Principals

of the agricultural and veterinary colleges from all over India attended the session. Important recommendations made to the Government are :

1. organisation of vocational agricultural schools of Manjri type, one school per district ;
2. establishment of an agricultural college for temperate zone (Hilly regions of Punjab, Uttar Pradesh, West Bengal, Himachal Pradesh and Jammu and Kashmir) ;
3. adoption of a five-year course in agriculture after matriculation in all the universities culminating in a degree, practical training on a farm to be necessary for a degree ;
4. a revised syllabus for undergraduate studies in veterinary colleges in India ;
5. N. E. S. Blocks to be attached with all agricultural/veterinary colleges ;
6. agriculture and animal husbandry departments to bring about effective co-ordination of research, teaching and extension at the agricultural and veterinary colleges ;
7. organisation of short courses in poultry, dairying, horticulture, plant protection, fruit preservation, etc., at the agricultural colleges for the benefit of professional farmers ;
8. observation of farmer's days in agricultural and veterinary colleges so as to enable the farmers to come into contact with the scientific workers. Establishment of an agricultural museum to serve as a perennial source of interest and instruction to the farmers in each college ;
9. active participation in agricultural colleges by the forthcoming *rabi* campaign to help the farmers increase their production ;
10. provision for in-service training at the agriculture and veterinary colleges to the staff employed in the agriculture, animal husbandry, community development and co-operative Departments ;
11. organisation of seminars by agricultural and veterinary colleges to discuss obligations, responsibilties and discipline of students ;
12. arrangements for a diploma course in teaching methods and techniques for the benefit of agricultural graduates employed as teachers in agricultural schools and colleges ;
13. a revolving fund of Rs. five lakhs should be created by the Indian Council of Agricultural Research for bringing out textbooks for Undergraduate students in agriculture and veterinary colleges ; and that
14. all agricultural and veterinary colleges should make adequate arrangements for display of Indian Council of Agricultural Research, publications. A specific amount should be earmarked for the purchase of Indian Council of Agricultural Research publications, stipends and scholarships.

SECOND JOINT INDO-AMERICAN TEAM ON AGRICULTURAL EDUCATION, RESEARCH AND EXTENSION

The Government of India has decided to constitute a second Joint Indo-American Team on Agricultural Education, Research and Extension with the following terms of reference :

1. To evaluate the progress of work pertaining to agricultural education, research and extension during the past five years.
2. Development of supplementary recommendations with regard to agricultural education, research and extension, with special reference to the Third Five-Year Plan.
3. To determine the extent to which the inter-institutional arrangement with the five Land Grant Colleges of U.S.A. has helped in the development of agricultural education, research and extension programme in the country and need for continuance of the above arrangement during the Third Five-Year Plan.

The Team is expected to start functioning in October, 1959 and will submit its report to the Government early in 1960.

Chapter VI

PUBLICATIONS AND PUBLICITY

PUBLICATIONS

The activities of the Council in regard to the sale of publications and procuring advertisements for its journals during the year under report showed an appreciable improvement. A large number of copies of new titles were sold in a comparatively short period. The total revenue from the sale of publications and advertisements was Rs. 8,11,880·14 and Rs. 88,566·00 respectively as against Rs. 7,91,843·14 and Rs. 71,166·19 during the year 1957-58.

For the benefit of the field workers engaged in agriculture, 26,76,648 copies of the Council's publications were supplied to the various C. D./N. E. S. Blocks under the scheme "Supply of Agricultural Information Literature to Village Level Workers".

JOURNALS

Indian Farming

The contents and get-up of the journal were considerably improved and it was made more attractive to the readers. Some new features were also introduced.

Indian Horticulture

The journal has now become quite popular with the horticulturists. Some new appealing features were introduced for wider readership.

Kheti (*Hindi*)

Some new features were introduced to cover a larger variety of topics dealing with the farmer's problems. The get-up was also considerably improved.

FARM BULLETINS

The following Farm Bulletins were issued :

English	*Hindi*
1. Improved Methods of Feeding Paddy Straw	1. Bee-keeping
2. Passion Fruit and *Jaman*	2. *Rashtriya Upvan* (Revised Edition)
3. Trends in Agricultural Research, III	3. *Vana Mahotsava* (Reprint)
4. The Litchi in India	4. The Guava in India
5. How to Utilize Carcases	5. *Ghar Ke Bagiche ki Rooprekha*
6. Ipecac Cultivation in India	6. The *Ber* in India

English	*Hindi*
7. Jute Cultivation in India	7. Cattle Breeds in India
8. *Bajra* Cultivation of India	8. *Vriksha Ropan*
9. Wind Erosion, Wind-breaks and Shelter-belts	9. Oranges, Limes and Lemons (Reprint)
10. Manufacturing Western Dairy products	10. Wheat Cultivation in India
11. Nurseries in India	11. Home Preservation of Fruits
12. Castor Cultivation in India	

LEAFLETS AND PAMPHLETS

The following leatflets and pamphlets were issued:

English	*Hindi*
1. How to Grow Pears	1. Better Profits from Sheep
2. How to Grow Peaches	2. How to Grow Bananas
3. How to Grow Apples	3. Rearing Chicks in a Home Brooder
	4. How to Make a Brooder
	5. How to Start a Poultry Farm
	6. Feeding Sheep
	7. Selecting and Preparing Birds for Poultry Shows

BOOKS

The following book was published during the year under report:

Agriculture and Animal Husbandry in India.

Results of studies on Rinderpest Campaign were produced and widely distributed.

An *ad hoc* publication 'Laying out Japanese Gardens in India' was also published during the period under report.

PUBLICATION COMMITTEE

A meeting of the Publication Committee was held on the 3rd October, 1958. It recommended continuance of some former schemes and recommended the following new schemes for adoption by the Council:

1. Enhancement of the grant of subsidy to scientific journals from 1/3 to 1/2 of the cost of printing, subject to a maximum of Rs. 3,000.

2. Printing of Council's scientific publications in Hindi.

3. Preparation of a book containing botanical and English names of agricultural and horticultural plants with their Hindi equivalents.

4. Creation of a revolving fund for publication of monographs and other books of the Council. The intention was that the sales of such publications should be ploughed back into the revolving fund.

5. Taking over of printing of the two scientific journals, *i.e.*, Indian Journal of Agricultural Science, and Indian Journal of Veterinary Science and Animal Husbandry from the Chief Controller of Printing and Stationery by the Council.

6. Publication of a six-monthly journal on Agricultural and Veterinary Education.

7. Preparation of a monograph on Banana.

The Publication Committee was reconstituted for a period of three years with effect from the 1st April, 1959, by the Governing Body.

The following films have been produced by the Council during 1958-59 :

1. Wheat (three reels), 2. Cotton (Northern Region) (three reels), 3. Mango (two reels), 4. Bidi Tobacco (two reels), 5. Cashew-nut (two reels).

A film on 'Produce Clean Milk' (two reels) was also produced during the last year. The Films Division was requested to dub those films into regional languages according to the requirements of the States and Commodity Committees.

ANIMAL, HEALTH INFORMATION SERVICE

The Animal Health Information Service was initiated in 1947 to provide up-to-date information on the prevalence of some important diseases of livestock. Statistical Bulletins are compiled every month and issued free of cost to all State Directors, Principals of Veterinary Colleges and heads of Central and State Research Institutes in the country. In addition, these bulletins are also issued to the embassies and consulates of many foreign countries. So far, 139 bulletins have been issued including 12 issued during the year under report.

Chapter VII

LIBRARY

During the year April 1958 to March 1959, several new services were initiated and there was a considerable increase in work and activities of the library ; these activities included acquisition, reorganisation and development, technical work, routine services and statistics.

ACQUISITION SECTION

Twelve hundred and thirty-one publications and 4,500 reports and bulletins were added as against 684 in the previous year. Four lists of additions to library were prepared and circulated to officers. Eleven thousand current issues of periodicals and 5,727 newspapers were received and registered.

Reorganisation and Development

As per recommendations of Dr. Shaw, the Council's library underwent a gradual process of reorganisation and development. Good amount of duplicates, old and superceded publications, and unwanted materials were carefully weeded out and sent to libraries needing them.

New items of Work and Services

These included—

Indian Council of Agricultural Research book insurance scheme. To assist the libraries in the agricultural and veterinary colleges, to implement open access so that the students and the faculty members get liberal and free access to books and publications for consultation.

Assistance for Book Selection. To enable the college librarians to build choice collection of books in their respective libraries, special book selection bibliographies were compiled on specific subjects in agriculture and animal husbandry for this purpose, and distributed to colleges selected as tools for book selection. Eight such bibliographical lists covering a total of 866 select entries were prepared and distributed. This service was welcomed and acclaimed as most useful by the Principals of the Agricultural and Veterinary Colleges.

Documentation Services. The Council initiated two publications to provide intensive literature service to colleges, research institutes, stations and farms, numbering more than 600. These are: Documentation of agriculture—the bulletin of current references on agriculture in India; Documentation of animal husbandry—the bulletin of current references on animal husbandry in India. Two such lists with 406 references have so far been issued.

Library Advisory Circular Letters. For developing a medium for continuous advisory services on all aspects of library work, technique and services, circular letters were started by the librarian. Two circular letters issued were greatly appreciated by the colleges

and acclaimed as very useful service by the T. C. M. Experts, working in the different States. On request from Dr. F. W. Parker, these letters were distributed to most of the T. C. M. Experts.

Library Service Leaflet. Two library service leaflets (1) on how to control silver fish, and (2) eliminating scratches on microfilms were prepared and distributed.

The catalogue of the Indian Council of Agricultural Research is being developed and organised to meet the demands of documentation service and maintaining them.

Inspection and Advisory Service. On specific request, the Council's librarian visited libraries of Fertilizer Association of India, New Delhi ; Agricultural College, Kanke, Ranchi ; and Indian Lac Research Institute, Namkum, Ranchi ; and advised them on the layout, furniture, equipment, implementing open access, organisation, classification, cataloguing and other routine as well as technical problems.

Consultation Service. The Librarian, Rajasthan College of Agriculture was deputed to the Council's library for a week for consultation regarding furniture, equipment, depth classification and organisation work. He was duly advised how to equip and develop his library on modern lines for efficient service to students and the faculty.

Training. The library was asked to provide short-term training for untrained clerical staff and refresher course for trained librarians now working in agricultural and veterinary college libraries. This plan will be implemented soon.

Routine Technical Work. All the books and publications received during the year, were classified and catalogued. Catalogued cards numbering 2,781 were prepared and filed. The classified catalogue is being organised to meet the demands of documentation service. The number of 1,043 volumes were compiled and bound during the year as against 900 during the previous year.

Routine Services. The number of loan transactions of books and publications was 4,541 as against 4,627 during the previous year. A slight reduction was observed in the number of books loaned, but there was a sharp increase in the number of visitors (8,548 against 5,862 during the previous year) and the books consulted within the library.

As many as 23,106 publications were consulted against 19,000 in the previous year. Inter-library loans were extended to 30 libraries or institutes within Delhi and outside at Cuttack, Madras, Anand, Waltair, Simla, Kurnool, Almora, Bikaner, Poona and to Kansas in U. S. A. The Council's library loaned publications from 13 libraries to service the special requirements of the officers of the Council. Besides answering a large number of ready reference questions with the help of reference books, the library handled 74 reference questions requiring search and location of literature or compilation of bibliographies. Nine biblographies covering a total of 158 entries were prepared and serviced during the year. Current issue of 161 periodical titles were circulated to advisers and other officers.

STATISTICS

Library statistics for the year under report are as follows:

	1957-58	1958-59
Books and Publications added	684	1,231
Current periodical issues received	6,953	11,000
No. of reports received	293	424
No. of bulletins etc. received	3,500	4,076
Newspapers received	6,537	5,727
No. of readers	5,862	8,584
No. of loan transactions	4,627	4,541
Consultation service	19,000	23,106
No. of publications classified	600	800
No. of catalogue cards prepared more than	4,500	2,781
No. of bibliographical lists prepared	8	10
No. of entries made	..	566
No. of Documentation lists	..	2
No. of entries made	..	406
No. of Advisory Circular letters	..	2
No. of Library Service Leaflets	..	2
No. of publications bound	900	1,043

APPENDIX I

Schemes, Continuation of which was Sanctioned

S. No.	*Name of the Scheme*	*Sponsoring authority*
1.	Evolving paddy strains for lift irrigation areas	Andhra Pradesh
2.	Improvement of high altitude of paddy	Assam
3.	Breeding salt and flood resistant varieties of paddy	West Bengal
4.	Rice improvement	Kashmir
5.	Improvement of hill paddy	West Bengal
6.	Work on rice in saline areas	Andhra Pradesh
7.	Breeding flood resistant varieties of paddy	Assam
8.	Rice improvement	Madhya Pradesh
9.	Extension of staff for the *ad-hoc* Committee on rice	I.C.A.R
10.	Multiplication and distribution of hybrid maize seeds	Mysore
11.	Pulse improvement	West Bengal
12.	Study of genetics and variability in algae	I.A.R.I.
13.	Pre-soaking seeds in nutrient salts	Viv. Lab., Almora and I.A.R.I.
14.	Plant physiology and plant introduction	Viv. Lab., Almora
15.	Wheat breeding	Rajasthan
16.	Investigation of intergeneric and interspecific Hybridization with Indian wheats	Poona
17.	Banana research	West Bengal
18.	Date palm	Punjab
19.	Research on bunchy top diseases of banana	Kerala
20.	Citrus manurial trials	Punjab
21.	Fruit preservation, B. R. College	Agra
22.	Citrus die-back	Mysore
23.	Citrus die-back	Bombay
24.	Citrus fruit research	Tharsa, Bombay
25.	Physiological studies of factors governing root formation in cuttings and layerings of fruit trees	Calcutta University
26.	Medicinal plants	West Bengal
27.	Improvement of *ber* fruit	Punjab
28.	Improvement of vegetables	Madras
29.	Improvement of vegetables	Punjab

APPENDIX I—(*Contd.*)

S. No.	*Name of the Scheme*	*Sponsoring authority*
30.	Improvement of vegetables	Jammu & Kashmir
31.	Insect pests of fruits and vegetables	Punjab
32.	Research on cashewnut	Kerala
33.	Research on cashewnut	Mysore
34.	Research on pepper	Kerala
35.	Investigations of *foorki* disease of cardamom	West Bengal
36.	Award of research fellowships in various branches of agriculture	I.C.A.R.
37.	Termite research	I.A.R.I.
38.	Nutritional biological studies of insects of agricultural importance	I.A.R.I.
39.	Termite research	Z.S.I., Calcutta
40.	Physiological relationship between insect pests and their best plants	Delhi University
41.	Reclamation of saline and alkaline lands	Madras
42.	Photo-chemical nitrogen fixation in soils	Sheela Dhar Inst.
43.	Usar land reclamation	Sheela Dhar Inst.
44.	Studies on phosphate availability in rice soils	Andhra Pradesh
45.	Reclamation of alkaline and saline soils	Punjab
46.	Standardization of methods of soil analysis	Bombay
47.	Green manuring	Himachal Pradesh
48.	Green manuring	Bihar
49.	Water requirements of crops	Bombay
50.	Improvement of sheep and wool on regional basis	Bombay
51.	Improvement of sheep and wool on regional basis	Jammu & Kashmir
52.	Liaison Officer (Sheep and Wool)	I.C.A.R.
53.	Duck breeding	I.V.R.I.
54.	Duck breeding	Kerala
55.	Poultry development	Kerala
56.	Angora goat breeding	U.P.
57.	Chick hatchery—poultry processing plant	American Arcot Mission Agri. Inst., Madras
58.	Breeding of goats for meat production	West Bengal
59.	Cross breeding in poultry	Allahabad Agril. Inst.
60.	Development of standardization of methods for detecting adulteration and estimating major constituents of milk	Punjab University

APPENDIX I—(*Contd.*)

S. No.	*Name of the Scheme*	*Sponsoring authority*
61.	Physiology of hump and the sheath of cattle	West Bengal
62.	Coordination of research on animal husbandry	I.C.A.R.
63.	Improvement in the technique and methods used in the manufacture of virus vaccine	Madras
64.	Rabies research-*cum*-diagnostic centre	I.V.R.I.
65.	Determination of normal worm burden in sheep and goats and normal facal egg output in cattle and buffaloes	Punjab
66.	Lumber paralysis in sheep and goats	Punjab
67.	Parasitic diseases with special reference to liver-fluke diseases	Mysore
68.	Control of mainfluke diseases of bovines	Mysore
69.	Causes of retention of placenta in bovines	Orissa
70.	Disease investigation officer (Pepsu region)	Punjab
71.	Cross breeding of cattle in hilly and heavy rainfall areas	Andhra Pradesh
72.	Cross breeding of cattle in hilly and heavy rainfall areas	Assam
73.	Cross breeding of cattle in hilly and heavy rainfall areas	Bihar
74.	Cross breeding of cattle in hilly and heavy rainfall areas	Kerala
75.	Cross breeding of cattle in hilly and heavy rainfall areas	Madras
76.	Cross breeding of cattle in hilly and heavy rainfall areas	Punjab
77.	Cross breeding of cattle in hilly and heavy rainfall areas	Manipur
78.	Central artificial insemination station	Bangalore
79.	Selective breeding and grading up of local cattle (Ohmsa)	Orissa
80.	Physiological genetics of different breeds of cattle	West Bengal
81.	Eastern regional animal nutrition centre	Harringhata Farm, West Bengal.
82.	Southern regional animal nutrition centre	N.D.R.I., Bangalore
83.	Nutritional requirements of buffaloes	B.R. College, Agra
84.	Study of production and consumption aspects of agricultural families in different class structure in Anand area	Anand

APPENDIX I—(*Concld.*)

S. No.	*Name of the Scheme*	*Sponsoring authority*
85.	Study of cultivation and yield of mango crop in Saharanpur distt.	I.C.A.R.
86.	Publication of "Journal of Agril. Education"	I.C.A.R.
87.	Printing of indices of scientific journals	I.C.A.R.
88.	Printing of quarterly journal "Statistical Newsletter"	I.C.A.R.
89.	Preparation of the monograph on cereal crops	I.C.A.R.
90.	Monograph, entitled 'Poisonous Plants of India—Volume II'	I.C.A.R.
91.	Extension of the post of sub-editor in the scheme for the preparation of monograph on algae	I.C.A.R.
92.	Setting up of a film production unit	I.C.A.R.
93.	Publication of monthly Hindi Journal "Kheti"	I.C.A.R.
94.	Supply of agricultural information literature to N.E.S. and C.D. Blocks	I.C.A.R.
95.	Publication of a quarterly popular journal "Indian Horticulture"	I.C.A.R.
96.	Integrated publicity work	I.C.A.R.
97.	Publication of half-yearly "Potato Journal"	I.C.A.R.
98.	Publication of crop calendars, crop diaries, charts of plant diseases, etc.	I.C.A.R.
99.	Printing of reviews of research work done in India in the fields of agriculture, animal husbandry and allied subjects	I.C.A.R.
100.	Printing of text-books for village schools	I.C.A.R.

APPENDIX II

NEW SCHEMES WHICH WERE SANCTIONED

S. No.	*Name of the Scheme*	*Sponsoring authority*
1.	Orange Research scheme	Kerala
2.	Coordinated scheme of floriculture at nine centres (eight states and one at IARI)	Drawn up by I.C.A.R.
3.	Influence of metal cheleted compounds on the yield of paddy	Madras
4.	Cytological, anatomical & embryological studies on wheat, maize and phaseolus.	I.A.R.I.
5.	Anatomical, embryological and cytological studies in rice	C.R.R.I.
6.	Embryology of pulses	College of Science, Nagpur.
7.	Embryology and anatomy of citrus species	Punjab University
8.	Anatomical and embryological studies in Potato	C.P.R.I.
9.	Selection of nuceller root stocks in citrus species with the help of cultural embryology	U.P.
10.	Cytogenetical investigation of the important cucurbitaceous vegetables	Calcutta University
11.	Survey for the assessment of possibilities of cut flower business	I.C.A.R.
12.	Studies on the spore content of the atmosphere	Andhra University
13.	Investigation of bovine pamphlegia and paraylsis	Mysore
14.	Setting up of a central animal husbandry information bureau.	I.C.A.R.
15.	Studies on different methods of chilling milk	N.D.R.I.
16.	Farming of fresh water prawns in confined water at Manthend, Karimnagar distt.	Andhra Pradesh
17.	Formation of hybrids from early tested inbreds of White Leghorn and Rhode Island Red.	U.P.
18.	Studies on the preparation of fermented milk	N.D.R.I.
19.	Studies on the manufacture of cheddar cheese from market milk	N.D.R.I.
20.	Comparing performance of different strains of poultry by applying random sample tests, model scheme	I.V.R.I.
21.	Preparation of peptone from fish (pilot scheme)	Andhra Pradesh
22.	Breeding short term rice strains possessing seed dormancy	Madras

APPENDIX II—(*Contd.*)

S. No.	*Name of the Scheme*	*Sponsoring authority*
23.	Breeding superior saline and alkaline resistant strains of paddy	Madras
24.	Trials on deep water paddies	Mysore
25.	Rice Research Workers' Conference, 1959	I.C.A.R.
26.	Pulse improvement	Kerala
27.	Study of nitrogen fixing blue-green algae	Madras
28.	Study of fodder production under rainfed and irrigated conditions	Kerala
29.	Co-ordinated scheme on floriculture	Assam
30.	Maintenance and propagation of seeds and bulbs of imported ornamental plants, main centre at Shrinagar with three sub-centres at Simla, Mussoorie and Ootacamund (Co-ordinated scheme)	I.C.A.R.
31.	Banana diseases	Madras
32.	Improvement of Anab-e-Shahi grapes of Hyderabad	Andhra Pradesh
33.	Cytogenetical studies on fruit crops	Agri. College, Coimbatore.
34.	Fruit preservation	Annamalai University
35.	Intensification of research on sub-tropical fruits	Himachal Pradesh
36.	Research on onions	Bombay
37.	Improvement of nutritional quality of Indian vegetables	I.A.R.I.
38.	Cultivation of Singharas	Orissa
39.	Research on resin grapes	Lahaul Valley (Punjab).
40.	Intensification of research on nuts with particular references to almonds, peanuts, etc.	Himachal Pradesh
41.	Establishment of Research-*cum*-testing centres for bullock driven agricultural implements	I.A.R.I.
42.	Implementation of Mr. K. Mori's report on floriculture in India.	
	(i) Training abroad of Shri Jindal (ii) Requisition of the services of a team of Japanese experts. (iii) Printing of Mr. K. Mori's report.	I.C.A.R.
43.	Procurement of the services of a horticultural expert from France	I.C.A.R.
44.	Seminar on diseases of horticultural plants	I.C.A.R.
45.	Establishment of pepper research station	Mysore

APPENDIX II—(*Contd.*)

S. No.	*Name of the Scheme*	*Sponsoring authority*
46.	Establishment of research station on spices (Coorg)	Mysore
47.	Research on the study of field rats (co-ordinated scheme)	Madras, Bombay, Andhra Pradesh, Punjab, U.P.
48.	Taxonomic and physiobiological studies on the plant parasitic nematodes of agricultural importance and their control	I.A.R.I.
49.	Intensive studies on systematics, biology and control of some of the serious pests in the Indian Union	I.A.R.I.
50.	Nitrogen metabolism of phytopathogenic fungi	Delhi University
51.	Conference of the Entomological and Mycological Research Workers, June, 1958	I.C.A.R.
52.	Structure studies of Punjab soils	Punjab
53.	Studies on soil structure in Andhra Pradesh	Andhra Pradesh
54.	Humification of organic matter, its relation to the fertility status and physico-chemical properties of light soils	Madhya Pradesh
55.	Relation between moisture content and fertility of level on the selected cropping schemes	Agril.Inst., Allahabad
56.	Research on placement of fertilizers for jowar, groundnut, cotton etc.	College of Agriculture, Dharwar.
57.	Establishment of a research unit for study of sheep production in a mixed farming economy	Punjab
58.	Suitable and cheap poultry houses for rural areas	Madhya Pradesh
59.	Scope for increased duck production in the *Bet* areas	Punjab
60.	Determination of the ideal conditions for the commercial storage of eggs	I.V.R.I.
61.	Popularising the rearing of baby chicks	I.V.R.I.
62.	Preparation and standardization of rennets of animal and vegetable origin for cheese manufacture	N.D.R.I.
63.	Study of detailed mineral composition and mineral balance in milk	N.D.R.I.
64.	Study on the economics of specialized dairy farming under various conditions at N.D.R.I.	N.D.R.I.

APPENDIX II—(*Contd.*)

S. No.	*Name of the Scheme*	*Sponsoring authority*
65.	Study on the economics of specialised dairy farming under various conditions at Institute of Agriculture, Anand . . .	Inst. of Agriculture, Anand.
66.	Study on the economics of specialised dairy farming under various conditions at Bara Joint Co-operative Society, Patiala .	Bara Joint Co-operative Society Patiala.
67.	Study on the economics of specialised dairy farming under various conditions at Madras	Madras
68.	Survey of bacteriological quality of Milk in Trivandrum	Kerala
69.	Manufacture of brine cured *Edam* cheese (ball type) and *Gauda* cheese (small flat loaf) from standardised buffalo milk.	Aarey Milk Colony, Bombay.
70.	Investigations into Salmonella in India especially at organized poultry farms . .	I.V.R.I.
71.	Investigation into infectious coryza and allied conditions in poultry	I.V.R.I.
72.	Disease investigation (pigs)	Andhra Pradesh
73.	Control and eradication of eqizootic Lymphegitis amongst Equidae.	D.A.R.V.F.
74.	Endo-crinological factors involved in the etiology of head cancer in cattle . .	U.P.
75.	Provision of technical and clerical staff to the Co-ordinating Officer (mastitis schemes) .	I.V.R.I.
76.	Provision of technical and clerical staff to the Co-ordinating Officer (bumpsore schemes).	I.V.R.I.
77.	Investigation into the improved methods of fish preservation	Andhra Pradesh
78.	Brackish water fish culture, Adyar . . .	Madras
79.	Investigations into the improved methods of transport and short-time preservation of fresh-water fish.	Jadavpur University, West Bengal.
80.	Survey of the yak and cattle breeding operations in the interior hilly areas	I.C.A.R.
81.	Systematic supply of poultry ration . .	Punjab
82.	Economics of poultry ration	Madhya Pradesh
83.	Development of suitable nutritious pasture grasses and legumes at different altitudes and climatic conditions.	Himachal Pradesh

APPENDIX II—(*Contd.*)

S. No.	*Name of the Scheme*	*Sponsoring authority*
84.	Introduction of annual irrigated pastures on arable land in Military Farms to provide high quality forage with a view to reduce supplementary feeding of cencentrates to absolute minimum without affecting the milk production of dairy cows and buffaloes.	Farms Wings, Meerut
85.	Studying the effect of feeding economic balanced concentrate mixtures as against cotton-seeds or cotton-seed cake alone to buffaloes.	Inst. of Agriculture, Anand.
86.	Cost of production of vegetables at five centres in the Punjab with headquarters at Ludhiana	Punjab
87.	Enquiry into factors influencing cropping pattern on individual holdings (co-ordinated scheme)	Agri. College, Ludhiana; Dte. of Agri., Patna; Inst. of Agri., Anand; Utkal Krishi Mahabidyalaya, Bhubaneswar; B. R. College, Agra; Agri. College, Bapatla.
88.	Pilot project for study of yield and cultivation practices of fruit crops.	I.C.A.R.
89.	Pilot enquiry for ascertaining the cost of poultry and egg production at a few selected farms.	Do.
90.	Pilot study of incidence of pests and diseases on rice in Cuttack distt. Orissa.	Do.
91.	Statistical analysis of the data in the co-ordinated scheme for survey of bacteriological quality of milk supply at Anand, Delhi and Allahabad—provision of staff.	Do.
92.	Survey to work out the cost of production of sheep and wool.	Bombay
93.	Survey to work out the cost of production of sheep and wool.	Rajasthan
94.	Survey to work out the cost of production of sheep and wool.	Andhra Pradesh
95.	Publication of textbooks for agricultural and veterinary College students.	I.C.A.R.
96.	Printing of Council's scientific publications in Hindi.	Do.
97.	Printing of the I. J.A.S. and I.J.V.S. & A.H. at private press.	Do.

APPENDIX II—(*Contd.*)

S. No.	*Name of the Scheme*	*Sponsoring authority*
98.	Preparation of monograph on banana	I.C.A.R.
99.	Grant of Rs. 5,000 to the Aarey Milk Colony for purchase of books.	Milk Commissioner, Bombay.
100.	Revision of fund from the donations by the officers.	I.C.A.R.
101.	Revision of a monograph entitled Insect pests of cultivated crops.	Do.
102.	Preparation of books on agricultural subjects for children.	Do.
103.	Creation of a revolving fund for the Council's publications other than journals and such publications as are supplied free on subsidised basis.	Do.
104.	Sale arrangements of the monographs issued by the Commodity Committees.	Do.
105.	Providing funds for publicity of books and adding it to the cost of publications.	Do.
106.	Investigation of biological nitrogen fixation under different Indian conditions with particular reference to practical agriculture.	Punjab
107.	Establishment of a sub-humid tropical fruit research station.	Andhra Pradesh
108.	Comparative efficiency of ammonical and nitrate fertilizers on paddy.	I.A.R.I.
109.	Improved technique of Chinese method of paddy cultivation.	Uttar Pradesh
110.	Trials of imported and improved agricultural implements in all States (Co-ordinated Scheme).	I.C.A.R.
111.	Morphology and biology of common paddy cutworm.	Aligarh University
112.	Taxonomy of some chaloid parasites of Indian scale insects.	Do.
113.	Micronutrient studies on soils	Kerala
114.	Investigation of agronomical requirements of improved strains of vegetables, crops and bionomics of brinjal shoot and fruit borer.	Institute of Agriculture, Anand.
115.	Sprinkler irrigation	I.C.A.R.
116.	Termite research	Forest Research Institute.
117.	Development of rose varieties of essential oils	I.A.R.I.

APPENDIX II—(*Contd.*)

S. No.	*Name of the Scheme*	*Sponsoring authority*
118.	Working out the method of application of liquid ammonia under village conditions.	I.A.R.I.
119.	Co-ordinated scheme for the use of chemical tissue and leaf analysis as means of diagnosing nutrient requirement of crops plants.	I.C.A.R.
120.	Production of sterility in laboratory animal.	C.D.R.I.
121.	Standardisation of methods of estimating total solids and solids-not-fat in milk by calculation.	N.D.R.I.
122.	Scheme for the comparative study of the efficiency of cow and buffalo in milk production at different levels of nutrition.	Institute of Agriculture, Anand.
123.	Investigation on toxic plants and herbs lethal to domestic animals.	Mysore
124.	Investigation on toxic plants and herbs lethal to domestic animals.	Madras
125.	Investigation on toxic plants and herbs lethal to domestic animals.	Uttar Pradesh
126.	Improving honey yield of per hives	Andhra Pradesh
127.	Reproduction studies in kankarej cows and Surti buffaloes.	Institute of Agri., Anand.
128.	Study of chemical constituents and Haematological aspects of blood of different breeds of domestic animals.	Mysore
129.	Evolution of new varieties of Dolichos lab-lab	Madras
130.	Banana Research sub-station, East Khandesh	Bombay
131.	Date palm, Kutch	Bombay
132.	Investigations into diseases of papaya	Agri. College, Poona, Bombay.
133.	Agronomic investigations on a few important commercial vegetables.	Agri. College, Poona, Bombay.
134.	Study of the effects of improved bullock drawn agril. implements on the physical properties of soil and crop performance.	B. R. College, Agra.,
135.	Establishment of cashewnut research station	Madras
136.	Investigation for forage insects.	Rajasthan
137.	Survey of beneficial coccinolids and investigations into their utilisation in the control of aphid, coccids and mites pests of crops.	Mysore
138.	Investigation of the actinomycete population of the paddy soil.	Agri. Deptt., Annamalai University, Madras State.
139.	Trace elements in Indian soils	I.A.R.I.

APPENDIX II—(*Contd.*)

S. No.	*Name of the Scheme*	*Sponsoring authority*
140.	Reclamation of Saline lands	Rajasthan
141.	Studies on the acid soils	Kerala
142.	Installation of steam injectors to induce artificial rain.	Dr. R. Savur, Delhi, I.C.A.R.
143.	Agronomic research on black soils region of South India.	Madras
144.	Study of : (a) the heritability and correlation of economic characters in sheep, and (b) the influence of environment on some of the exotic and Indian breeds of sheep	Uttar Pradesh
145.	Standardising the process for the manufacture of (i) Sterilized cream, (ii) tinned butter, and (iii) refining tinned ghee.	Kaira Union (Bombay).
146.	Investigation and control of Surra . . .	I.V.R.I.
147.	Biological control of Fasciolissis by introduction of ducks.	Andhra Pradesh
148.	Causes of reproductive failure in buffalo cows during the summer months.	Uttar Pradesh
149.	Investigation on toxic plants and herbs lethal to domestic animals.	Punjab
150.	Investigation on the adoption of improved practices and the capital invested on different types and sizes farms.	College of Agriculture, Dharwar (Mysore).
151.	Appraisal of overall benefits of improvement in farming and possibilities of budgeting approach to improve the farm earning in Bihar.	Bihar
152.	Studies of the advantages and economics of mechanised farming.	Madras
153.	Preparation of a book containing Botanical and English names of Agricultural and Horticultural Plants with their Hindi equivalents.	I.C.A.R.
154.	Scheme for the appointment of Liaison Officer (Sheep and Wool) for the guidance, Co-ordination and Supervision of the activities of the regional Sheep Breeding and Wool Producing Stations established in different States under the I.C.A.R.	I.C.A.R.
155.	Usarland reclamation Sheila Dhar Institute, Allahabad.	Allahabad

APPENDIX II—(*Concld.*)

S. No.	*Name of the Scheme*	*Sponsoring authority*
156.	Photo-chemical Nitrogen Fixation in Soils, Sheila Dhar Institute, Allahabad.	Allahabad
157.	Improvement of Sheep and Wool on regional basis, Bombay.	Bombay
158.	Medicinal Plants, Kashmir	Kashmir
159.	Printing of reviews on Agriculture and Animal Husbandry Subjects.	I.C.A.R.
160.	Popularization of ready to feed balanced Poultry feed mixture.	
161.	Survey of Fertilizer Practices, Punjab .	Punjab

APPENDIX III

Schemes which Terminated

S. No.	*Name of the Scheme*	*Sponsoring authority*
1.	Breeding non-lodging non-shedding and flood-resistant varieties of paddy.	Madhya Pradesh
2.	Rice breeding (Coorg)	Mysore
3.	Striga attack on Sorghum	Andhra
4.	Hybrid cumba	Madras
5.	Horticulture	Himachal Pradesh
6.	Training in fruit and vegetable preservation	Madhya Pradesh
7.	Co-ordinated scheme on the effect of chemicals on the storage of fruits and vegetables.	C.F.T.R.I.
8.	Do.	Punjab
9.	Chlorosis of banana	Bombay
10.	Investigation on pests of vegetables	Andhra
11.	Improvement of vegetables	Madhya Pradesh
12.	Do.	Himachal Pradesh
13.	Do.	Kashmir
14.	Medicinal plants	Assam
15.	Turmeric	Andhra
16.	Ginger	Assam
17.	Pests and diseases of cashewnut	Mysore
18.	Soil conditions	West Bengal
19.	Physiology of rice flowering	West Bengal
20.	Use of phytohormones for higher yield	Bombay
21.	Chemical stimulation of ovules	Delhi University
22.	Termite research	Anand
23.	Systematic and Biological studies of ardent fauna	Delhi University
24.	Augmenting the named insect collections	Coimbatore
25.	Scheme for the study of the rates of decomposition of insecticidal deposits.	Osmania University, Hyderabad
26.	Survey of fertilizer practices	Punjab

APPENDIX III—(*Contd.*)

S. No.	*Name of the Scheme*	*Sponsoring authority*
27.	Livestock investigation	Punjab
28.	Improvement of Kangayam breed of cattle	Madras
29.	Causes of degeneration of cattle	I.V.R.I.
30.	Artificial insemination	I.D.R.I.
31.	Fundamental study of quantitative inheritance	I.V.R.I.
32.	Veterinary investigation (cattle)	Mysore
33.	Do.	Rajasthan
34.	Biology and systematics of hill leeches	Delhi University
35.	Investigation of mastitis	Bombay
36.	Improvement of vaccine	Madras
37.	Laying trials in poultry	I.V.R.I.
38.	Using cows for work	I.V.R.I.
39.	Setting up of an exhibition unit	I.C.A.R.
40.	Cattle sterility	I.V.R.I.
41.	Development of ginger	Kerala
42.	Training centres land records	I.C.A.R.

APPENDIX IV

The following meetings were held during the year:

	Name of the Body	*No. of meetings*
1.	Agricultural and Animal Husbandry Regional Committees	7
2.	Scientific Committees	45
3.	Working Party on Agriculture	1
4.	Working Party on Animal Husbandry	1
5.	Board of Research	1
6.	Advisory Board	1
7.	Standing Finance Committee	2
8.	Governing Body	1
9.	Annual General Meeting	1
10.	Special General Meetings	2

APPENDIX V

Members of the Indian Council of Agricultural Research Society

1. The Minister for Food and Agriculture, Government of India, New Delhi
2. The Vice-President, Indian Council of Agricultural Research, New Delhi
3. The Deputy Minister for Agriculture, Government of India, New Delhi
4. The Minister in-charge of Agriculture, Government of Andhra Pradesh, Hyderabad-Deccan
5. The Mnister in-charge of Agriculture, Government of Assam, Shillong
6. The Minister in-charge of Agriculture, Government of Bihar, Patna
7. The Minister in-charge of Agriculture, Government of Bombay, Sachivalaya, Bombay
8. The Minister in-charge of Agriculture, Government of Kerala, Trivandrum
9. The Minister in-charge of Agriculture, Government of Madhya Pradesh, Bhopal
10. The Minister in-charge of Agriculture, Government of Madras, Fort St. George, Madras
11. The Minister in-charge of Agriculture, Government of Mysore, Bangalore
12. The Minister in-charge of Agriculture, Government of Orissa, Cuttack
13. The Minister in-charge of Agriculture, Government of Punjab, Chandigarh
14. The Minister in-charge of Agriculture, Government of Rajasthan, Jaipur
15. The Minister in-charge of Agriculture, Government of Uttar Pradesh, Lucknow
16. The Minister in-charge of Agriculture, Government of West Bengal, Calcutta
17. The Minister in-charge of Agriculture, Government of Jammu and Kashmir, Srinagar, Jammu Tawi
18. The Chief Commissioner of Delhi, Delhi
19. The Lt. Governor of Himachal Pradesh, Simla

APPENDIX V—(*Contd.*)

20. The Chief Commissioner of Manipur, Imphal
21. The Chief Commissioner of Tripura, Agartala.
22. The Chief Commissioner, Andaman and Nicobar Islands, Port Blair
23. The Administrator, Laccadives, Minicoy and Amindivi Islands, Kozhikode-4
24. The Director of Agriculture, Andhra Pradesh, Hyderabad-Deccan
25. The Director of Agriculture, Assam, Shillong
26. The Director of Agriculture, Bihar, Patna
27. The Director of Agriculture, Bombay State, Poona
28. The Director of Agriculture, Kerala, Trivandrum
29. The Director of Agriculture, Madhya Pradesh, Rewa
30. The Director of Agriculture, Madras State, Madras
31. The Director of Agriculture, Mysore State, Bangalore
32. The Director of Agriculture, Orissa, Cuttack
33. The Director of Agriculture, Punjab, Chandigarh
34. The Director of Agriculture, Rajasthan, Jaipur
35. The Director of Agriculture, Uttar Pradesh, Lucknow
36. The Director of Agriculture, West Bengal, Calcutta
37. The Director of Agriculture, Jammu and Kashmir, Srinagar/Jammu Tawi
38. The Director of Animal Husbandry, Andhra Pradesh, Hyderabad-Deccan
39. The Director of Veterinary Services and Animal Husbandry, Assam, Gauhati
40. The Director of Animal Husbandry, Bihar, Patna
41. The Director of Veterinary Services, Bombay State, Poona
42. The Director of Animal Husbandry, Kerala State, Trivandrum
43. The Director of Veterinary Services and Animal Husbandry, Madhya Pradesh, Rewa
44. The Director of Animal Husbandry, Madras State, Madras

APPENDIX V—(*Contd.*)

45. The Director of Animal Husbandry and Veterinary Services, Mysore State, Bangalore

46. The Director of Animal Husbandry and Veterinary Services, Orissa, Cuttack

47. The Director of Veterinary Services, Punjab, Simla

48. The Director of Veterinary Services and Animal Husbandry, Rajasthan, Jaipur

49. The Director of Animal Husbandry, U. P., Lucknow

50. The Director of Veterinary Services and Animal Husbandry, West Bengal, Calcutta

51. The Director of Veterinary Services, Jammu and Kashmir, Srinagar/Jammu Tawi

52. Shri L. C. Negi, Director of Agriculture, Himachal Pradesh, Simla

53. Shri G. C. Negi, Deputy Director of Animal Husbandry, Himachal Pradesh, Simla

54. The Secretary to the Government of India, Ministry of Food and Agriculture (Dept. of Agri.), New Delhi

55. Shri Dayabhai Vallabbhai Patel, 68, Marine Drive, Bombay /21, Western Court, New Delhi

56. Shri K. Madhava Menon, Member, Rajya Sabha, Padmalayam, Kozhikode, Kerala State,/71-North Avenue, New Delhi

57. Shri T. Sanganna, Member, Lok Sabha, Rayaguda, P. O. Rayaguda, Distt. Koraput, Orissa,/134, Constitution House, New Delhi

58. Shri M. Shankaraiya, Advocate, Member, Lok Sabha, 111, Main Road, Vani Vilas Mohalla, Mysore City,/14-D, Feroze-Shah Road, New Delhi

59. Sardar Iqbal Singh, Member, Lok Sabha, House No. 662, Ward No. 6, Abohar, Punjab, 85-D/South Avenue, New Delhi

60. Shri P. R. Patel, Member, Lok Sabha, Pilaji Ganj, Mehsana, Bombay State,/15-A South Avenue, New Delhi

61. Shri Matadin Khaitan, 9-Ramkumar Rakhit Lane, Calcutta 7

62. Shri A. R. Foster, C/o. M/s. Imperial Chemical Industries (India) Private Ltd., P.O. Box. No. 107, New Delhi

63. The Agricultural Commissioner with the Government of India, New Delhi

64. The Animal Husbandry Commissioner with the Government of India, New Delhi

APPENDIX V—(*Contd.*)

65. The Agricultural Marketing Adviser to the Government of India, Nagpur

66. The Director, Indian Agricultural Research Institute, New Delhi

67. The Director, Indian Veterinary Research Institute, Izatnagar

68. The Director, Indian Institute of Science, Bangalore

69. The Director, Central Rice Research Institute, Cuttack

70. The Director, Central Potato Research Institute, Simla

71. The President, Forest Research Institute and Colleges, P. O. New Forest, Dehra Dun

72. The Director, Institute of Agriculture, Anand

73. The Director, National Dairy Research Institute, Karnal

74. Shri Thakur Das Bhargava, Member, Lok Sabha, Anand Bhavan, Hissar,/31, Canning Lane, New Delhi

75. The Secretary, Central Board of Forestry, (Min. of F. & A.) Department of Agriculture, Government of India, New Delhi

76. The Director General, Council of Scientific and Industrial Research, New Delhi

77. Shrimati Lilavati Munshi, Bharatiya Vidya Bhavan, Chowpatty Road, Bombay,/Bharatiya Vidya Bhavan, Curzon Road, New Delhi

78. The Inspector-General of Forests, (Min. of F. & A.), Department of Agriculture, Government of India, New Delhi

79. Shri J. S. Patil, B.A., LL.B., Chalisgaon District, East Khandesh, Bombay State

80. Dr. C. G. Pandit, Director, Indian Council of Medical Research, New Delhi

81. Dr. A. C. Joshi, Vice-Chancellor, Punjab, University, Chandigarh

82. Shri K. P. Bhatnagar, Vice-Chancellor, Agra University, Agra

83. Dr. V. S. Krishna, Vice-Chancellor, Andhra University, Waltair

84. Dr. P. K. Parija, Vice-Chancellor, Utkal University, Cuttack.

85. Shri H. Ferguson, Director, Scientific Department, Indian Tea Association, P. O. Chinnamara, Assam

86. Shri K. T. Uthappa, Bison Field Estate, Sidapur Post, S. Coorg

APPENDIX V—(*Contd.*)

87. Shri K. N. Kaimal, Rubber Production Commissioner, Rubber Board, Kottayyam

88. The Director of Remounts, Veterinary and Farms, Quarter Master General's Branch, Army Head Quarters, New Delhi

89. Shri B. L. Sethi, Secretary, Indian Central Cotton Committee, 14-Nicol Road, Ballard Estate, Bombay-1

90. Shri N. B. Maity, Member, Lok Sabha, E-14 Durga Charan Mitra Street, Calcutta,/149-A North Avenue, New Delhi

91. Shri B. L. Singh, C/o. M/s Bhagirath Ram and Sons, 14, Bentinck Street, Calcutta

92. Shri C. Bali Reddy, Member, Lok Sabha. Secretary, Andhra Provincial Kisan Sammelan, Cumum Distt., Kurnool, Andhra Pradesh,/183-D, South Avenue, New Delhi

93. Shri P. Balarama Kurup, Techno-chemical Industries, P.O. Box No. 74, Kozhikode, Malabar District, Kerala

94. Shri Mohanlal Ambalal Parikh, C/o. M/s. Mohanlal Hargovindas, 51, Dadyseth Agiary Lane, Bombay-2

95. Shri G. U. Rao, 54, Kondappa Chetty Street, G. T. Madras-1

96. Shri C. T. Ittiachan, Kootanad Estate, South Malabar, Kerala State

97. Shri Madanmohan R. Ruia, C/o. M/s. Ramnarain Sons Private Ltd., State Bank Building Annexe., Bank Street, Fort, Bombay-1

98. Shri J. G. Walton, Vice-President, Indian Central Jute Committee, c/o. Thomas Duff & Co., (India) Ltd., Clive Row, Calcutta

99. Sardar Lal Singh, Village P. O. and District Nandpur, Ludhiana,/7, Kotah House, New Delhi

100. Shri K. P. Madhavan Nair, Member, Rajya Sabha, Vice-President, Indian Central Coconut Committee, Ernakulam Mills Buildings, Ernakulam,/26, Queen Victoria Road, New Delhi

101. Shri S. Mehta, Proprietor, Virginia Tobacco Planters, Station Road, Saharanpur, U.P.

102. Shri H. Sitarama Reddy, Landlord and Director, Rayalaseema Mills, Adoni

103. Shri U. Subraya Mallia, Vice-President, Indian Central Arecanut Committee, C/o. M/s. U. Vasudeva Subraya Mallia & Co. Ltd., Exporters, Bunder, Mangalore

104. The Economic and Statistical Adviser, Department of Agriculture, Government of India, New Delhi

APPENDIX V—(*Concld.*)

105. The Statistical Adviser, Indian Council of Agricultural Research, New Delhi

106. The Fisheries Development Adviser to the Government of India, Ministry of Agriculture, New Delhi

107. Shri K. Sachidanandam, Deputy Secretary to the Government of India (Finance), Ministry of Food and Agriculture, Financial Adviser, Indian Council of Agricultural Research, New Delhi

108. Shri O. P. R. Reddiar, Subha Sanmargha Nilayam, Vadalur, Vadalur P. O. *Via* Cuddalore Junction, South Arcot District

109. Shri J. Raghotam Reddy, Malayal Village, Fateh Maidan, North Road, Hyderabad-Deccan

110. Shri Srikanth Kaul, c/o Parash Seed Farm, Srinagar

111. Shri K. P. Amritnatha Iyer (L. A.) Kottarathu, Madhom, Monocompu, Kerala State

112. Dr. M. Channa Reddy, M. L. A., Anand Niwas, Lalguda, Secunderabad, Andhra Pradesh

113. Shri Baburao Krishanji Patil, Land-holder, P.O. Digras, Distt. Yeotmal, Bombay

114. Sardar Satwant Singh, Nasirpur Farm, P.O. Bahadurgarh Fort, Patiala

APPENDIX V

Members of the Governing Body

1. Shri A. P. Jain, Minister for Food and Agriculture Government of India, New Delhi (President)
2. Dr. M. S. Randhawa, I.C.S., Vice-President, Indian Council of Agricultural Research, New Delhi
3. Shri M. V. Krishnappa, Deputy Minister for Agriculture, Government of India, New Delhi
4. Shri P. Thimma Reddy, Minister in-charge of Agriculture. Animal Husbandry, Forest and Fisheries, Government of Andhra Pradesh, Hyderabad-Deccan
5. Shri Moinul Haque Chaudhury, Minister in-charge of Agriculture (including Food Production), Veterinary, Animal Husbandry and Pisciculture, Government of Assam, Shillong
6. Shri Bir Chand Patel, Minister in-charge of Agriculture, Veterinary and Co-operation, Government of Bihar, Patna
7. Shri Vasant Phulsing Naik, Minister for Agriculture (including Veterinary and Animal Husbandry), and Aarey Milk Colony, Government of Bombay, Sachivalaya, Bombay
8. Shri C. Achutha Menon, Minister in-charge of Finance and Agriculture (including Veterinary and Animal Husbandry) Government of Kerala, Trivandrum
9. Shri Takhat Mal Jain, Minister for Industries in-charge of Agriculture (including Veterinary and Animal Husbandry), Government of Madhya Pradesh, Bhopal
10. Shri M. Bhaktavatsalam, Home Minister in-charge of Agriculture and Animal Husbandry, Government of Madras, Fourt, St. George, Madras
11. Shri K. F. Patil, Minister for Agriculture and Forests, Government of Mysore, Mysore Government Secretariat, Vidhan Sabha, Bangalore
12. Shri Radha Nath Rath, Minister in-charge of Agriculture (including Veterinary and Animal Husbandry), Government of Orissa, Cuttack
13. Giani Kartar Singh, Minister in-charge of Agriculture, Government of Punjab, Chandigarh
14. Shri Nathu Ram Mirdha, Minister in-charge of Agriculture, Co-operation and Forests, Government of Rajasthan, Jaipur
15. Shri Mohan Lal Gautam, Minister in-charge of Agriculture (including Veterinary and Animal Husbandry), Government of Uttar Pradesh, Lucknow
16. Dr. R. Ahmed, Minister in-charge of Agriculture, Animal Husbandry and Forests, Government of West Bengal, Calcutta
17. Shri Shamsuddin, Minister in-charge of Agriculture, Government of Jammu and Kashmir, Srinagar/Jammu Tawi

APPENDIX VI—(*Contd.*)

18. Shri K. R. Damle, I.C.S., Secretary to the Government of India, Ministry of Food and Agriculture (Department of Agriculture), New Delhi
19. Shri A. D. Pandit, I.C.S., Chief Commissioner of Delhi, Delhi
20. Shri Bajrang Bahadur Singh, Lt. Governor of Himachal Pradesh, Simla
21. Shri J. M. Raina, I.A.S., Chief Commissioner of Manipur, Imphal
22. Shri N. M. Patnaik, I.A.S., Chief Commissioner of Tripura, Agartala
23. Shri T. G. N. Ayyar, I. C. S., Chief Commissioner, Andaman and Nicobar Islands, Port Blair
24. Shri S. Moni, Administrator, Laccadive, Minicoy and Amindivi Islands, Kozhikode-4
25. Shri K. Sachidanandam, Financial Adviser, Indian Council of Agricultural Research, New Delhi
26. Shri H. Siddaveerappa, 1081, 11 Road, P. J. Extension, Danangere, Mysore State
27. Shri S. K. Sen, Director of Animal Husbandry, Bihar, Patna
28. Shri Thakur Das Bhargava, Member, Lok Sabha, Anand Bhavan, Hissar/31, Canning Lane, New Delhi
29. Shri Baburao Krishnaji Patil, Land-holder and President, Municipal Committee Digras, District Yeotmal, Bombay State
30. Sardar Satwant Singh, Land-holder, Nasirpur Farm, Bahadurgarh Fort, Patiala
31. Dr. M. Channa Reddy, M.L.A. 17, Anand Niwas, Lalguda, Secunderabad, Hyderabad-Deccan Andhra Pradesh
32. Shri K. Madhava Menon, Member, Rajya Sabha, Padmalayam, Kozhikode, Malabar,/71, North Avenue, New Delhi
33. Shri T. Sanganna, Member, Lok Sabha, Rayaguda, P. O. Rayaguda, District Koraput, Orissa,/134, Constitution House, New Delhi
34. Shri M. Shankaraiya, Advocate, Member, Lok Sabha, 111, Main Vani Vilas Mohalla, Mysore City,/134, Constitution House, New Delhi

APPENDIX VII

Members of the Standing Finance Committee

1. Shri K. R. Damle, I.C.S., Secretary to the Government of India, Ministry of Food and Agriculture (Department of Agriculture), New Delhi
2. Dr. M. S. Randhawa, I.C.S., Vice-President, Indian Council of Agricultural Research, New Delhi
3. Shri K. Sachidanandam, Financial Adviser, I. C. A. R., New Delhi
4. Shri Vasant Phulsing Naik, Minister in-charge of Agriculture and Forests, Government of Bombay, Bombay
5. Shri Mohan Lal Gautam, Minister in-charge of Agriculture, Government of Uttar Pradesh, Lucknow
6. Shri Satwant Singh, Land-holder, Nasirpur Farm, Bahadurgarh Fort, Patiala
7. Shri Thakur Das Bhargava, Advocate, Member, Lok Sabha, Anand Bhavan. Hissar,/31, Canning Lane, New Delhi
8. Shri M. Shankaraiya, Advocate, Member, Lok Sabha, 111, Main Road, V. V. Mohalla, Mysore City
9. Dr. E. S. Narayanan, Principal, Central College of Agriculture, P. O. I. A. R. I., New Delhi
10. Shri H. R. Kapoor, Principal, Bihar Veterinary College, Patna

APPENDIX VIII

Members of the Advisory Board

1. The Vice-President, Indian Council of Agricultural Research, New Delhi
2. The Agricultural Commissioner with the Government India, New Delhi
3. The Animal Husbandry Commissioner with the Government of India, New Delhi
4. The Extension Commissioner, Ministry of Food and Agriculture (Deptt. of Agriculture), New Delhi
5. The Agricultural Marketing Adviser to the Government of India, Nagpur
6. The Economic and Statistical Adviser to the Government of India, Ministry of Food and Agriculture (Department of Agriculture), New Delhi
7. The Statistical Adviser, Indian Council of Agricultural Research, New Delhi
8. The Director, Indian Agricultural Research Institute, Izatnagar
9. The Director, Indian Veterinary Research Institute, Izatnagar
10. The Director, Indian Istitute of Science, Bangalore
11. The Directtor, National Dairy Research Institute, Karnal
12. The Director, Central Rice Research Institute, Cuttack
13. The Director, Central Potato Research Institute, Simla
14. The Director of Agriculture, Andhra Pradesh, Hyderabad—Deccan
15. The Director of Agriculture, Assam, Shillong
16. The Director of Agriculture, Bihar, Patna
17. The Director of Agriculture, Bombay State, Poona
18. The Director of Agriculture, Kerala State, Trivandrum
19. The Director of Agriculture, Madhya Pradesh, Rewa
20. The Director of Agriculture, Madras State, Madras
21. The Director of Agriculture, Mysore State, Bangalore
22. The Director of Agriculture, Orissa, Cuttack
23. The Directtor of Agriculture, Punjab, Chandigarh
24. The Director of Agriculture, Rajasthan, Jaipur
25. The Director of Agriculture, Uttar Pradesh, Lucknow
26. The Director of Agriculture, West Bengal, Calcutta
27. The Director of Agriculture, Jammu and Kashmir, Srinagar/Jammu Tawi

APPENDIX VIII—(*Contd.*)

28. The Director of Animal Husbandry, Andhra Pradesh, Hyderabad-Dn
29. The Director of Veterinary Services and Animal Husbandry Assam, Gauhati
30. The Director of Animal Husbandry, Bihar, Patna
31. The Director of Veterinary Services, Bombay State, Poona
32. The Director of Animal Husbandry, Kerala State, Trivandrum
33. The Director of Veterinary Services, Madhya Pradesh, Rewa
34. The Director of Animal Husbandry, Madras State, Madras
35. The Director of Animal Husbandry, Mysore State, Bangalore
36. The Director of Veterinary Services and Animal Husbandry, Orissa, Cuttack
37. The Director of Veterinary Services and Warden of Fisheries (Punjab), Simla
38. The Director of Veterinary Services and Animal Husbandry, Rajasthan, Jaipur
39. The Director of Animal Husbandry, Uttar Pradesh, Lucknow
40. The Director of Veterinary Services and Animal Husbandry, West Bengal, Calcutta
41. The Director of Veterinary Services, Jammu and Kashmir, Srinagar/Jammu Tawi
42. Shri L. S. Negi, Director of Agriculture, Himachal Pradesh, Simla
43. Shri G. C. Negi, Deputy Director of Animal Husbandry, Himachal Pradesh, Simla
44. The President, Forest Research Institute and Colleges, P.O. New Forest, Dehra Dun
45. Shri J. S. Patil, B.A. LL.B., Chalisgaon, District East Khandesh, Bombay State
46. Dr. C. G. Pandit, Director, Indian Council of Medical Research New Delhi
47. Dr. A. C. Joshi, Vice-Chancellor, Punjab University, Chandigarh
48. Shri K. P. Bhatnagar, Vice-Chancellor, Agra University, Agra
49. Dr. V. S. Krishna, Vice-Chancellor, Andhra University, Waltair
50. Dr. P. K. Parija, Vice-Chancellor, Utkal University, Cuttack
51. Shri H. Ferguson, Director, Indian Tea Association, Scientific Department, P. O. Cinnamara, Assam
52. Shri B. L. Sethi, Secretary, Indian Central Cotton Committee, 14, Nicol Road, Ballard Estate, Bombay-1

APPENDIX VIII—(*Contd.*)

53. Shri N. B. Maity, Member, Lok Sabha, 149-A, North Avenue, New Delhi,/E-14/Durga Charan Mitra Street, Calcutta
54. Shri B. L. Singh, C/o. M/s. Bhagirath Ram Sons, 14, Bentinck Street, Calcutta
55. Sri C. Bali Reddy, Member, Lok Sabha, Provncial Secretary, Andhra Kisan Sammelan, 183-D. South Avenue, New Delhi/Cumbum, District Kurnool, Andhra Pradesh
56. Shri P. Balarama Kurup, Techno-Chemical Industries, P. O. Box No. 74-Kozhikode, Malabar District
57. Shri Mohanlal Ambalal Parik C/o. Mohanlal Hargovinddas, 51-Dadyseth, Agiary Street, Bombay-2
58. Shri G. U. Rao, 54, Kondappa Chetty Street, G. T. Madras-1.
59. Shri C. T. Ittiachan, B.Sc. (Agri.), Kootanad Estate, Kootanad, South Malabar, Kerala State
60. Shri K. N. Kaimal, Rubber Production Commissioner, Rubber Board, Kottayyam, Kerala State
61. Shri K. T. Uthappa, Bison Field Estate, Sidapur Post, South Coorg
62. Dr. N. K. Panikkar, Fisheries Development Adviser to the Government of India, Ministry of Food and Agriculture (Department of Agriculture), New Delhi
63. The Director, Indian Institute of Sugarcane Research, Lucknow
64. The Director, Sugarcane Breeding Institute, Coimbatore
65. Dr. V. N. Khanolkar, Director, Indian Cancer Research Centre, Parel, Bombay-12
66. Dr. R. S. Vasudeva, Head of the Division of Mycology. Indian Agricultural Research Institute, New Delhi
67. Dr. E. S. Narayanan, Head of the Division of Entomology, Indian Agricultural Research Institute, New Delhi
68. Col. R. N. Chopra, Honorary Scientific Adviser, Regional Research Laboratory, Residency Road, Srinagar/Jammu Tawi
69. Shri D. A. Gadkari, Officer on Special Duty, Political and Services Department (Planning and Development), Government of Bombay, Bombay
70. Dr. S. Krishnamurthi, Head of the Division of Horticulture, Indian Agricultural Research Institute, New Delhi
71. Dr. K. C. Naik, Principal, Agricultural College and Research Institute and Joint Director of Agriculture (Research), Coimbatore
72. Dr. S. S. Purewal, Vegetable Botanist to the Government of Punjab, Agricultural College, Ludhiana

APPENDIX VIII—(*Contd.*)

73. Dr. T. J. Mirchandani, Director, Agronomic Survey and Experimentation, Indian Council of Agricultural Research, New Delhi

74. Dr. J. K. Basu, Director of Soil Conservation (Agriculture). Ministry of Food and Agriculture (Department of Agriculture), New Delhi

75. Dr. L. C. Sikka, Dairy Development Adviser to the Government of India, Ministry of Food and Agriculture (Dept. of Agri.), New Delhi

76. Shri S. S. Khot, Sheep and Wool Liaison Officer, Indian Council of Agricultural Research, New Delhi

77. Shri S. G. Iyer, Head of the Division of Poultry, Indian Veterinary Research Institute, Izatnagar

78. Dr. N. D. Kehar, Principal Post-graduate College, Indian Veterinary Research Institute, Izatnagar

79. Dr. P. S. Lokanathan, Director General, National Council of Applied Economic Research, Parliament Street, New Delhi

80. Dr. B. C. Kundu, Director, Jute Agricultural Research Institute, Barrackpore, Calcutta

81. Dr. S. Krishnaswamy, Entomologist, Indian Lac Research Institute, Namkum (Ranchi)

82. Sardar Lal Singh, Vice President Indian Central Sugarcane Committee, 7, Kotah House, New Delhi

83. Dr. P. J. Gregory, Secretary, Indian Central Coconut Committee, Ernakulam

84. Dr. M. S. Patel, Secretary, Indian Central Tobacco Committee, 38, Mount Road, Madras-6

85. Dr. R. Sankaran, Secretary, Indian Central Oilseeds Committee, Gandhi Bhavan, Hyderabad-Deccan

86. Shri B. S. Varadarajan, Secretary, Indian Central Arecanut Committee, P. B. No. 14, Kozhikode-1 (Calicut)

87. Dr. J. S. Patel, Adviser (Agriculture), Ministry of Community Development, New Delhi

88. Dr. P. M. N. Naidu, Adviser (Animal Husbandry), Ministry of Community Development, New Delhi

89. Shri G. R. Valunjkar, Director, Leather Industry, Khadi and Village Industries Commission, Express Building, Opposite Church Gate, Bombay-1

90. Dr. B. D. Leroia, Development Officer (Science), University Grants Commission, Old Mill Road, New Delhi

91. The Director of Remounts, Veterinary and Farms, Quarter Master General's Branch, Army Headquarters, New Delhi

92. The Livestock Development Adviser to the Government of India, Ministry of Food and Agriculture (Department of Agriculture), New Delhi

APPENDIX VIII—(*Concld.*)

93. Shri Bishan Mansingh, Chairman Board of Agriculture, Fatehpur, Uttar Pradesh

94. Shri K. D. Sharma, Secretary, Farmers' Forum, India, Jawaharmal Mansion, 3/15A, Ajmeri Gate Extension, New Delhi

95. Dr. Z. R. Kothavalla, 8, Ali Aksar Road, Bangalore

96. Dr. P. S. Khankhoje, C/o. Shri R. K. Patel, Civil Lines, Nagpur

97. Dr. M. D. Patel, Director, Institute of Agriculture, Anand

98. Shri Ujjal Singh, 12-Curzon Road, New Delhi

99. Shri H. Siddaveerappa, 1083, 11 Road, P. J. Extension, Davanger, Mysore State

APPENDIX IX

Statement of Income and Expenditure of the Indian Council of Agriculture Research for the year 1958-59

RECEIPTS

		Rs.
1. Opening Balance		21 85,503.54
2. Receipts Under A.P.C. Act		43,31,737.18
3. *Contributions and Grants*:		
(*a*) From Government of India	4,96,870.00	
(*b*) From Other Sources.	1,67,886.00	6,64,756.00
4. Interest on Investment		6,83,146.31
5. Miscellaneous Receipts		13,29,989.80
6. Debts & Remittances		2,18,834.66
TOTAL		94,13,967.49
Investments and Re-Investments		37,00,000.00
GRAND TOTAL		131,13,967.49
I. Opening Balance		21,85,503.54
II. Receipts during the year		72,28,463.95
III. Investment & Re-Investment		37,00,000.00
		131,13,967.49

PAYMENTS

1. *Headquarter Schemes*		
(*a*) Standing Charges		7,13,569.44
(*b*) Agriculture Schemes		3,91,457.43
(*c*) Animal Husbandry Schemes		98,254.96
(*d*) Miscellaneous		13,76,502.21
TOTAL		25,79,784.04
2. *Grants-in-aid*		
(*a*) Agriculture Schemes		20,26,983.20
(*b*) Animal Husbandry Schemes		14,46,374.21
(*c*) Combined Agriculture & A. H. Schemes		70,678.20
(*d*) Miscellaneous		29,808.67

APPENDIX IX—(*Contd.*)

3. Contribution to Various Institutions	37,250.00
4. Debts & Remittances	2,89,613.29
5. Refund to Government of India	3,49,856.65
TOTAL	68,30,328.26
Closing Balance	30,83,639.23
TOTAL	99,13,967.49
Investment & Re-Investment	32,00,000.00
GRAND TOTAL	131,13,967.49
Payment during the year	68,30,328.26
Investment & Re-investment	32,00,000.00
Closing Balance	30,83,639.23
TOTAL	1,31,13,967.49

II. Particulars of advances, permanent and temporary, outstanding at the end of the year.

Impress (in the name of Addl. Secretary, I.C.A.R.)	1 000.00

III. Particulars of securities, etc.

	Face Value	Purchase Value
Particulars of Securities—	Rs.	Rs.
1. 3% Victory Loan, 1959-61	5,00,000.00	5,03,125.00
2. 3% Stock 1963-65	16,49,500.00	15,54,334.00
3. 2¾% Stock 1962(i)	4,00,000.00	4,02,736.56
(ii)	5,50,000.00	5,50,000.00
4. 3% Loan 1970-75	63,09,400.00	54,99,882.02
5. 3½% N. P. Bonds 1961	10,11,400.00	10,00,000.00
6. 3¾% Loan 1974	35,53,200.00	34,99,902.00
7. 4% Loan 1972	18,56,200.00	18,56,200.00
8. Forty three short term deposit receipts No. A001102 to A001144	21,50,000.00	21,50,000.00
9. Five short term deposit receipts No. A 027809 to A 027812 & A 027814	5,00,000.00	5,00,000.00
10. Sixteen fixed deposit receipts No. A 038265 to A 038278	16,00,000.00	16,00,00.00
11. Six fixed deposit receipts No. A 038577 to A 038582	6,00,000.00	6,00,000.00

APPENDIX IX—(*Contd.*)

	Face Value	Purchase Value
Particulars of Securities from Provident Fund Account.—	Rs. nP.	Rs. nP.
1. 12 Year National Saving Certificates No. NS/Fc87031 to 087035, 087037 to 087041	50,000.00	50,000.00
2. 12 Year National Saving Certificates No. NS/Fo28496, 028497, 063601 to 063610	60,000.00	60,000.00
3. 12 Year National Saving Certificates Nos NS/Fo87258 to 087263	30,000.00	30,000.00
4. 3½% National Plan Loan 1964 Safe Custody Receipt No. DH295	35,000.00	34,606.25
5. 3½% National Plan Loan 1964 Receipt No. DH 296	15,000.00	14,838.28
6. 12 Year National Saving Certificate No. G 113337 to G 113346	50,000.00	50,000.00
7. 12 Year National Saving Certificate No. FO-087126 & GO-110921 to GO-110931	60,000.00	60,000.00
8. 12 Year National Saving Certificate Nos. GO-013275	70,000.00	70,000.00
9. Short term deposit Receipt No. F. 22389	20,000.00	20,000.00
		2,01,05,624.11

IV. Particulars of Closing Balance

(*a*) Cash in Hand as per Cash Book on 31-3-59	802.98
(*b*) Cash with State Bank of India (General Account) as on 31-3-59	29,85,296.0
(*c*) Cash & Bank balance (Provident Fund)	97,540.16
TOTAL	30,83,639.23

Under Secretary,
Indian Council of Agricultulral Research
New Delhi

Audit Certificate

Certified that the above accounts have been audited & found correct subject to remarks in the Inspection Report.

(*Sd.*)—S. N. RUSTOGI,
Asst. Acctts. Officer.

APPENDIX X

(Referred to in Para 8)

ANNUAL ACCOUNTS OF THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH FOR THE YEAR 1958-59

RECEIPTS		GRANTS			PAYMENTS			
Head of Account	Receipt during the year	Total Receipts	Original	Net	Head of Account	Actual	Difference	Remarks
1	2	3	4	5	6	7	8	9
					A. STANDING CHARGES			
OPENING BALANCE	Rs.	Rs.	Rs.	Rs.		Rs. nP.	Rs. nP.	
1. Cash Balance .	2,903.99	21,85,503.54						
2. Bank Balance .	21,46,352.93		1,20,000	1,24,500	1. Accounts Audit .	1,24,408.76	(+)91.24(a)	(a) Inconsiderable.
3. Provident Fund Balance . .	36,246 62		10,000	8,800	2. Travelling Allowance of non-official members of the Council.	8,232.30	(+)567.70(a)	
TOTAL .	21,85,503.54							
I. *Receipts under the Agriculture Produce Cess.*		43,31,737.18	30,000	49,400	3. Travelling allowance of members of the Committees of the Advisory Board and of other persons invited to attend the meetings.	49,375.71	(+)24.29(a)	
II. *Contribution & Grants.*			2,000	2,700	4. T. A. of non-official members of the Board of Agriculture and A.H. in India.	2,637.80	(+)62.20(a)	
(a) *From constituents Statis. & other sources.*		1,67,886.00						

1. I.C.T.C. Madras	60,000.00	..	..	10,600	5. Miscellaneous grant of V.P.	10,525.56	(+)74.44(a)
2. I.C.T.C. Madras	2,000.00		60,000	12,500	6. Editorial staff for Indian Farming & Kheti.	12,401.52	(+)98.48(a)
3. *The Chief Research Officer Desert Aforestation, Jodhpur.*	70,000.00		20,000	8,300	7. Subsidies to various Journals.	8,292.00	(+)8.00(a)
4. *The Agril. propaganda Officer, of I & P. Assam, Shillong.*	30,000.00		2,00,000	1,89,500	8. Integrated statistical Scheme.	1,89,254.47	(+)145.53(a)
5. *I.C.C.C. Bombay*	5,886.00		500	50	9. Publication of abstracts for Indian Journal of Veterinary Science.	50.00	..
TOTAL . . .	1,67,886.00						
6. *From Central Government.*		4,96,870.00	1,50,000	10,600	10. Publicity Scheme .	10,541.78	(+)58.22(a)
			10,240	2,700	11. Publication of a quarterly Rice News Teller.	2,663.86	(+)36.14(a)
1. *Publicity & Propaganda.*			60,000	15,100	12. Publication of the Dharti-Ke-Lal.	15,014.07	(+)85.93(a)
Under Rinderpest Scheme.	30,000.00		4,000	..	13. Printing of technical bulletin in Scientific Review series.	..	..
2. Manurial & Agronomic Trials for 1958-59.	70,000.00		4,000	..	14. Publication of Research News Letter.	..	..
3. Production of Agril. Films, 1958-59.	1,40,000.00		50,000	15,100	15. Setting up of a Central Film Library.	15,095.80	(+)4.20(a)

(a) Inconsiderable.

1	2	3	4	5	6	7	8	9
						Rs. nP.	Rs. nP.	
4. Study of Milk Yield Breeds & management practices Bovines in the North Gujrat & Southern part of Bombay.	95,000.00		60,000	33,100	16. Press Section . .	33,006.93	(+)93.07(a)	
			40,000	12,400	17. Printing of Research and review series of Publications issued by the Council.	12,422.96	(—)22.96(a)	
5. Scheme for ascertaining the cost of milk Production.	78,000.00		70,000	3,200	18. Printing of handbook series of the Council.	3,186.92	(+)13.08(a)	
			1,81,280	1,55,800	19. Establishment of a central Distribution Section for the publications of the Council.	1,55,889.56	(—)89.56(a)	
6. Research *cum*-testing centres for bullock driven Agricultural implements, 1958-59.	10,000.00		10,000	10,700	20. Farm news and Press releases.	10,665.77	(+)34.23(a)	(g) Demand for funds was received late during the year.
			42,000	41,000	21. Library . . .	41,414.09	(—)414.09(a)	
7. Research & Development of pepper, & Cashewnut etc. 1958-59.	10,100.00		11,000	2,000	22. Compilation of the Agriculture and Animal Husbandry in India.	1,983.33	(+)16.67(a)	
8. Coordinated, cattle sterility 1958-59.	56,770.00		14,000	4,500	23. Abstraction of Horticultural Literature.	4,442.85	(+)57.15(a)	
9. Weed Control	1,790.00		5,000	2,100	24. Research workers conference on Agr. and A.H.	2,063.40	(+)36.60(a)	
10. Wheat Rust Control 1958-59.	5,210.00							
	4,96,870.00	6,83,146.31						

III. *Interest from Investment.*	
(i) 2¾% Loan, 1962	26,059.68
(ii) 3% Loan, 1963-65.	49,361.28
(iii) 3% 2nd Victory Loan 1959-61	14,962.50
(iv) 3¾% Loan, 1974	1,33,245.00
(v) 4% Loan 1972	74,248.00
(III) 3% Loan 1975.	1,88,808.80
(vi) 3½% Govt. N.P.B.	35,310.50
(vii) Fixed deposit etc.	1,10,000.00
(viii) Interest from short term receipts	51,150.55
TOTAL . .	6,83,146.31
IV. *Misc. Receipts.*	13,29,989.80
1. Receipts realised from Schemes.	2,49,126.21
2. Receipts on account of unspent balances of grants made by the Council.	1,90,687.79

B—RESEARCH TRAINING AND PUBLICITY UNDER DIRECT CONTROL OF I.C.A.R.

(i) AGRICULTUR

..	..	25. Grassland expert of the F.A.O. (Dr. R.O. Whyte)	781.10(g)	(—)781.10		
70,000	20,100	25A. Co-ordinated grass land survey Scheme.	19,802.75	(+)397.25(a)	(a) Inconsiderable.	
	8,400	26. Monograph on poisonous plant .	8,302.76	(+)97.24(a)	(B) Amount of Rs. 26104/ and Rs. 32971/ refunded to the Govt. of India have been shown under separate head.	
..	26,100	27. Weed Control . .	(—)4,420.00(B)			
26,200	20,500	28. Description of different varieties of fruit.	20,428.53	(+)71.47(a)		
7,65,000	89,400	29. Intensification of research in cotton, oilseeds and millets.	89,123.33	(+)276.67(a)	Head Quarter Amrauti	11,888.44
					Centre	6,212.09
..	4,000	30. Reconciliation of figures of Tobacco crops between A.P. & Tobacco Committee.	3,969.96	(+)30.04(a)	Kanpur Centre	26,260.09
					I.A.R.I. Centre	8,914.02
					Sirsa Centre	14,425.24
					Patiala Centre	15,467.34
..	18,000	31. *Ad-hoc* Committee on Rice under I.C.A.R. Rice Committee.	17,859.12	(+)40.88(a)	Coimbatore Centre	523.51
					Hyderabad Centre	5,432.60
18,750	37,900	32. Co-ordinated whea rust control.	4,852.28	(+)33047.78(B)		
17,380	34,700	33. Manurial trials & agronomic experiments.	34,609.25	(+)90.75(a)		89,123.33

1	2	3	4	5	6	7	8	9
						Rs. nP.	Rs. nP.	
3. Miscellaneous .	8,90,175.80		..	3,800	34. Spices and Cashew-nut show.	3,792.82	(+)7.18(a)	
TOTAL . .	13,29,989.80		15,670	15,200	35. Scheme for preparing Agricultural Hand book for India.	15,111.29	(+)88.71(a)	
V. *Debts. & Remittances.*			..	200	36. Proposal for obtaining Italian expert on Horticulture, Mycological and	122.00	(+)78.00(a)	
(i) Loans & Advances.	656.00	2,18,834.66						
(ii) Deposits & Advances repayable.	1,53,576.78			4,000	37. Entomological Research workers conference on indigenous.	3,928.92	(+)71.08(a)	
(iii) Recoveries from Research staff on account of income tax Provident fund etc.	64,601.88		..	3,000	38. Agril. Implements in all states.	2,983.47	(+)16.53(a)	
				300	39. Co-ordinating Maize breeding Scheme.	250.00	(+)50.00(a)	
Total receipts, *opening balances.		94,13,967.49	6,000	..	40. Foreign expert for the Co-ordination of plant Harmones scheme.	..	..	(a) Inconsiderable.
Add.–Investments & Re-investments.	37,00,000.00							
			72,800	60,900	41. All India fruit shows.	58,903.62	(+)1,996.38(a)	
Grand Total:—		131,13,967.49						
			20,000	100	42. Publication of illustrated bulletins giving information about cultivation of individual drug plants,	10.73	(+)86.27(a)	

3,600	600	43. Donation of cups in flower show in different regions.	600 00	
49,100	..	44. Preparation of a book on flower annals by Sh. I. Desai.	..	..
..	57,600	45. Investigation into the method and practices of Farming.	57,527.02	(+)72.98(a)
..	5,300	46. Survey of Fertiliser Practices.	5,228.36	(+)71.64(a)
47,900	43,700	47. Co-ordination of Research.	43,638.86	(+)61 14(a)
10,000	..	48. Survey of Ag icultural practices.	..	..
..	900	49. Distribution of hybrid maize seeds.	855.75	(+)44.25(a)
12,12,400	2,700	50. Requisition for a Japanese expert to survey possible sites for laying gardens.	3,195.51	(—)495.51(a)
		(ii) ANIMAL HUSBANDRY		..
2,000	..	51. Monograph on Helminth Parasites of domesticated animals in India.	..	..
17,040	30,300	52. Appointment of a Liaison officer for sheep and Wool Schemes.	30,276.35	(+)23.65(a)

1	2	3	4	5	6	7	8	9
						Rs. nP.	Rs. nP.	
			4,120	9,800	53. Assignment of sheep and wool expert of F.A.O.	9,080.52	(+)719.48(a)	
			11,230	..	54. Consideration of the recommendation of the Committee of Indigenous drugs.	..	..	
			2,700	..	55. Manual on preparation of animals for Indian Markets.	..	..	
			..	16,900	56. Compilation and publication of Indian Diary year Book.	16,886.97	(+)13.03(a)	
			20,000	22,900	57. Co-ordination of Research on A. H. Creation of a Co-ordinated Unit.	22,813.67	(+)86.33(a)	
			1,900	..	58. Manual on Breeding of farm animal in India.	..	..	
			21,100	..	59. Intensified supervision and co-ordination on cattle breeding.	..	..	
			31,370	..	60. Training in meat technology.	..	..	
			60,200	..	61. Definition commercial evolution of Graded Wools of sheep brands.	..	..	

4,640	9,300	62. Cattle Sterility . .	9,289.18	(+)10.82(a)	
30,500	3,900	63. Expansion of central herdbook Section.	3,853.13	(+)46.87(a)	
24,000	6,100	64. Central Dairy information Bureau.	6,055.14	(+)44.86(a)	
5,770	..	65. Monograph on 'Statistical methods in A. H.'	..	..	
		(III) MISCELLANEOUS			
..	40	66. Co-ordinated crops cutting experiments.	35.00	(+)5.00 (a) (B)	Inconsiderable. It was refunded to the Govt. of India, (shown under separate head).
70,000	7,500	67. Integrated publicity work.	9,525.85	(—)2,025.85(a)	
1,00,000	55,200	68. National index of field experiments.	55,134.49	(+)65.51(a)	
31,670	17,400	69. Award of fellowships to the diploma course students in Agri. statistics.	17,310.63	(+)89.37(a)	
..	400	70. Assignment of Dr. F. Yates F. A. O. expert	305.70	(+)94.30(a)	
..	100	71. Training Centre for experimental design in Agri. and A. H.	9.00	(+)91.00(a)	
..	97,600	72. Study of milk yield breeds and management practices of Bovines.	97,611.13	(—)11.13(a)	

1	2	3	4	5	6	7	8	9
			..	25,000	73. Pilot Sample Survey, Pepper.	Rs. nP. ..	Rs. nP. (+)25,000(B)	Represents refund to Govt. of India.
			2,80,000	74,900	74. Setting up of Central Co-operative Film Production Unit.	74,865.87*	(+)34.13(a)	*Govt. of India's share 61003.33
			4,780	28,700	75. Display Advisory Service.	26,497.45	(+)1,502.55(a)	States Share 13862.54 74,865.87
			..	93,100	76. Cost of Milk Production in India.	93,379.58	(—)279.58(a)	
			..	700	77. Producing campaign material and training of states personnel.	645.24	(+)54.76(a)	
			..	93,500	78. Livestock & Fishery Statistics.	(—)5,103.00(B)		(B) Amount of Rs. 93,419 refunded to the Govt. of India shown under separate head.
			1,87,100	44,800	79. Building of the I.C.A.R.	45,010.81	(—)310.81(a)	
			44,650	64,100	80. Indian Council of Agricultural and Veterinary education.	63,945.12	(+)154.88(a)	
				47,000	81. Preparation of propaganda material for Rinderpest eradication.	4,936.45	(+)42,063.55(B)	Amount of Rs. 42073-17 refunded to the Govt. of India has been shown under separate head.

..	100	82. Appointment of Shri J. Malcolm Orchard under point four programmes.	..	(+)100(b)	(b) Demand for funds not received during the year.
..	5,300	83. Publication of a book on flowering trees in India.	5,254.36	(+)45.64(a)	
45,000	100	84. Publication of a hand book on Horticulture.	72.95	(+)27.05(a)	
54,270	6,600	85. Publication of Crop calenders and Charts.	46.857.73	(—)4,257.73(g)	(g) Demand for funds received late during the year.
9,07,860	5,59,400	86. Supply of Agriculture information literature to the National Extension Service Blocks.	5,59352.82	(+)47.18(a)	
1,05,920	5,400	87. Bringing out publications of the Council in regional languages.	5,380 50	(+)19.50(a)	
81,300	36,100	88. Setting up an Exhibition Unit.	36,081.76	(+)18.24(a)	
1,000	..	89. Securing of effective distribution for information material Produced by the I.C.A.R.	..	..	
7,050	3,800	90. Duplicating Section .	3,798.65	(+)1.35(a)	
..	71,800	91. Japanese method of Paddy cultivation.	1,144.60	(+)70,655.40(B)	(B) Amount of Rs. 70611-40 refunded to the Govt. of India shown under separate head.

1	2	3	4	5	6	7	8	9
						Rs. nP.	Rs. nP.	
			2,500	600	92. Printing of quarterly Journal Statistical News Letter.	538.55	(+)61.45(a)	
			15,000	12,400	93. Research fellowship in Agriculture	12,542.72	(—)142.72(a)	
			..	3,700	94. Survey of indigenous Implements.	3,644.67	(+)55.33(a)	
			10,000	..	95. Award for prizes for improvement in Agricultural Implements.	..	..	
			25,000	..	96. Award of prizes for outstanding Research Work done in the field of Agri. and A. H. and allied Sciences.	..	..	
			5,050	1,900	97. Proposal to invite eminent Statisticians under Colombo Plan	1,823.68	(+)76.32(a)	
			4,670	..	98. Publication of Dhartike-lal in regional languages.	..	..	
			29,300	1,800	99. Pilot Sample Investigation on the cultivation practices and yield on mango crops.	1,789.85	(+)10.15(a)	
			100	..	100. Membership of International Hides and allied Trades Society.	..	..	

10,000	..	101. Printing of small digests of important publications of the Council.	..	..	
9,910	600	102. Printing of the monograph on veterinary entomology and Acarology for India.	518.86	(+)81.14(a)	
79,950	6,600	103. Building of the I.C.A.R. (Stat. Wing).	6,535.54	(+)64.46(a)	
..	6,500	104. Using aerial photography for crop estimation.	3,465.36	(+)2,984.64(a)	
11,420	3,700	1050. Fellowships in Statis-	4,269.86	(—)569.86 (a)	(B) Amount of Rs 2,997.08 refunded to Govt. of India under a Separate head.
40,000	26,620	106. Printing of Kheti .	24,627.56	(+)1,972.44	
80,000	..	107. Estimation of cost of production of cotton and other rotation crops.	..	..	..
30,000	..	108. Supply of special publications of the Council on subsidized rates.	..	..	
23,500	..	109. Maintenance of statistical wing Building (I.C.A.R.).	..	..	
300	..	110. Award of I. C. A. R. gold medals to two statistical students.	..	..	
40,900	5,400	111. Pilot schemes for maintaining research project files.	5,337.00	(+)63.00 (a)	

1	2	3	4	5	6	7	8	9
						Rs. nP.	Rs. nP.	
		10,830	2,700	112.	Preparation of reviews on research work done in India in the field of agriculture and Animal Husbandry.	2,607.08	(+)92.92(a)	Inconsiderable.
		43,110	20,500	113.	Publication of a quarterly popular journal on 'Indian Horticulture'.	20,445.50	(+)54.50(a)	
		..	400	114.	Scheme for the analysing the data of Survey in Oilseeds crop etc.	366.41	(+)33.59(a)	
		..	12,600	115.	Publication of a monograph on 'Mango'.	12,585.18	(+)14.82(a)	
		29,000	15,200	116.	Publication of a Monograph on Rice in India.	15,196.62	(+)3.38(a)	
		10,000	..	117.	Publication of Potato Journal.	..	..	
		..	75,000	118.	Printing of Reviews on Agriculture & A. H. subjects.	7,471.56	(+)28.44(a)	
		49,100	..	119.	Preparation of a book of tuberous and bulbous plants.	..	..	

..	1,500	120.	Publication of monograph entitled 'Poultry'.	1,462.00	(+)38.00(a)
86,000	3,700	121.	Preparation of monograph on different groups of Fungi and the diseases of various Crops.	3,605.63	(+)94.37(a)
63,000	9,600	122.	Preparation of monograph on Algae.	9,141.71	(+)458.29(a)
4,000	100	123.	Reprinting of the hand-book on Statistical methods for Agriculture Workers by Dr. Panse & Sukhatme.	63.25	(+)36.75(a)
2,150	...	124.	Free supply of I.C.A.R. publications to the various agriculture and Veterinary colleges in India.	...	...
1,750	1,800	125.	Publication of a quarterly journal on Agricultural Education.	1,819.20	(—)19.20(a)
50,000	9,400	126.	Printing of Textbooks for village level workers.	9,356.57	(+)43.43(a)
40,000	...	127.	Preparation of textbooks on Entomology & Soil Science for students in Agricultural colleges I.C.A.R.	..	..

1	2	3	4	5	6	7	8	9
						Rs. nP.	Rs. nP.	
		3,100	2,200	128.	Preparation of indices of Scientific journal of the I.C.A.R. viz., I.J.V.S. & A.H. & I.J.A.S.	2,110.00	(+)90.00(a)	Inconsiderable.
		2,00,900	..	129.	Preparation of a series of monographs on A.H. subjects.	..	..	
		51,000	41,500	130.	Publication of a book entitled Agriculture & Animal Husbandry in India.	41,450.19	(+)49.81(a)	
		25,200	400	131.	Preparation of an album on Medicinal Plants.	390.00	(+)10.00(a)	
		5,000	32,000	132.	Printing of a comprehensive publication on Agricultural Research in India.	31,954.42	(+)45.58(a)	
		..	2,100	133.	Preparation of a monograph on different cereal crops.	2,012.39	(+)87.61(a)	
		..	4,000	134.	Grant of Rs. 5000/- to the Arey Milk Colony for purchase of books (M.C. Bombay).	4,000.00	..	
		15,000	..	135.	Monograph on fruit preservation in India.	..	..	

32,400	100	136. Preparation of books on flowering Shrubs & Flowering Creepers.	100	..
10,000	..	137. Reprinting of a Monograph on dry Farming in India.	..	..
..	3,300	138. Setting up of a Central Stores Organisation.	218.16	(+)81.84(a)
			13,76,502.21	

C—GRANTS-IN-AID

(I) AGRICULTURE

(a) *Rice*

3,100	..	139. Improvement of paddy M.B. (M.P.).	..	..
13,100	8,100	140. Rice Breeding, Punjab.	8,075.62	(+)24.38(a)
8,500	..	141. Rice Breeding, Coorg (Mysore).	..	..
20,650	..	142. Survey and collection of paddy. C.R.R.I. Cuttack.	..	..
14,500	10,600	143. Blast and foot rot diseases of Rice and wheat, Bombay.	10,494.82	(+)115.18(a)
10,600	7,300	144. Rice Stem borer Madras.	7,300.00	..

1	2	3	4	5	6	7	8	9
		Rs.	Rs.		(a) *Rice*—(Contd.)	Rs. nP.	Rs rP.	
		17,890	15,100	145.	Rice Stem borer Hyderabad, (Andhra).	15,012.80	(+)87.20(a)	
		14,630	8,300	146.	Rice Stem borer, West Bengal.	8,300.00	..	
		9,490	8,200	147.	Rice Stem borer, Andhra.	8,200.00	..	
		5,840	..	148.	Stem Rot disease of Rice, Madras.	..	..	
		13,000	12,000	149.	Boro paddy, West Bengal.	11,935.04	(+)64.96(a)	
		2,000	5,900	150.	Breeding salt and flood resistant varieties of Paddy, Assam.	5,900.00	..	
		6,000	..	151.	Breeding salt and flood resistant varieties of Paddy (Kerala).	..	..	
		20,000	15,000	152.	Breeding salt and flood resistant varieties of Paddy, West Bengal.	15,000.00	..	
		9,000	5,700	153.	Scheme for work on Rice in saline areas, Andhra.	5,657.00	(+)43.00(a)	
		10,000	..	154.	Cultural studies with upland paddy, West Bengal.	..	..	

6,300	5,000	155.	Blast resistance of paddy, Coimbatore, Madras.	5,000.00	..
3,150	..	156.	Investigation on Boro paddy, U.P.	..	..
4,500	..	157.	Deep water paddy, U.P.	..	..
9,000	..	158.	Drought resistant strains of paddy, Kerala.	..	..
..	14,600	159.	Drought resistant strains of paddy, Madras.	14,580.00	(+)20.00(a)
9,000	5,000	160.	Deep water paddy, Andhra.	5,000.00	..
12,000	..	161.	Rice Improvement scheme Kashmir.	..	(+) 29.00 (a)
9,370	..	162.	Breeding Varieties resistant to piricularia, Madras.	..	..
8,000	..	163.	Breeding Varieties resistant to piricularia, Andhra.	..	..
4,510	500	164.	Improvement of hill paddy, Assam.	498.55	(+)1.45(a)
..	40	165.	Increasing Rice yield, C.R.R.I.	40.00	..
6,000	..	166.	Breeding non-lodging, non-sheding and flood resistant Paddy, M.P.	..	..

1	2	3	4	5	6	7	8	9
			Rs.	Rs.		Rs. nP.	Rs. nP.	
					(a) *Rice*—(Contd.)			
			8,000	3,000	167. Breeding Paddy for lift irrigation areas Andhra.	3,036.00	(—)36.00(a)	(a) Inconsiderable.
			3,000	2,700	168. Tabi Nurseries of Paddy Andhra.	2,650.00	(+)50.00(a)	
			2,880	..	169. Bacterial Blight Diseases of Paddy Bombay.	..	..	
			17,500	..	170. Breeding strains Resistant to lodging of Rice C.R.R.I.	..	..	
			12,000	..	171. Induction and study of Amphiploidy in Rice W. Bengal.	..	..	
			3,680	3,000	172. Investigation of false smut of Paddy Andhra.	2,990.00	(+)10.00(a)	
			5,960	..	173. Evolution of Paddy strains for inundated areas Madras.	..	..	
			52,630	..	174. Evolving improved varieties of Rice Kerala.	..	..	
					(b) *Wheat and other Cereals*			
			..	1,700	175. Maize Breeding, Punjab	1,658.69	(+)41.31(a)	
			..	800	176. Maize Breeding U.P.	754.00	(+)46.00(a)	

..	2,300	177. Maize Breeding, Bihar	2,233.00	(+)67.00(a)
14,200	3,300	178. Maize Breeding & Paddy, W. Bengal.	3,300.00	..
4,380	13,200	179. Improvement of Pastures and legumes, I.A.R.I.	13,200.00	..
8,000	1,500	180. Improvement of pastures and legumes M.P. (Bombay).	27,419.00	(+)81.00(a)
33,910	26,000	181. Improvement of pastures and legumes, M.P. (Bombay).	..	..
6,740	..	182. Foot rot of wheat, Bombay (M.P.)	..	..
10,000	..	183. Study on wheat, (Bombay).	..	..
..	11,800	184. Maize Breeding, I.A.R.I.	11,716.00	(+)84.00(a)
2,200	..	185. Hybrid Maize, Mysore	..	..
20,000	52,400	186. Co-ordinated Maize Breeding Scheme—I.A.R.I.	52,325.00	(+)75.00(a)
5,900	5,100	187. Co-ordinated Maize Breeding Scheme—Kashmir.	5,009.25	(+)90.75(a)
..	20,400	188. Co-ordinated Maize Breeding Scheme—W. Bengal.	20,400.00	..

1	2	3	4	5	6	7	8	9
			Rs.	Rs.		Rs. nP.	Rs. nP.	
					(b) *Wheat and other Cereals*—(Contd.)			
			1,16,940	4,600	189. Co-ordinated Maize Breeding Scheme—Punjab.	4,519.60	(+)80.40(a)	
			..	8,200	190. Co-ordinated Maize Breeding Scheme—Bombay.	8,130.00	(+)70.00(a)	
			..	48,800	191. Co-ordinated Maize Breeding Scheme—U.P.	48,750.00	(+)50.00(a)	
			..	11,500	192. Co-ordinated Maize Breeding Scheme—Rajasthan.	11,231.68	(+)268.32(a)	
			..	25,900	193. Co-ordinated Maize Breeding Scheme—Vivekanand Laboratory, Almora.	25,844.00	(+)56.00(a)	
			..	71,000	194. Co-ordinated Maize Breeding Scheme—Andhra.	71,000.00	..	
			..	400	195. Co-ordinated Wheat Rust Control (Mahableshwar) Bombay.	336.00	(+)64.00(a)	

..	..	196. Co-ordinated Wheat Rust Control, Bombay (Nimphat). M.P. Rajasthan. Vivekananda Lab., Almora and Andhra.	(—)11,500.00	..	
..	..	197. Maize Breeding, Andhra, Hyderabad.	24.00	(—)24.00(a)	
..	600	198. Maize Breeding, Rajasthan.	808.00	(—)208.00(a)	
..	800	199. Maize Breeding PEPSU, Punjab.	785.55	(+)14.45(a)	
1,000	100	200. Wheat Breeding, Rajasthan.	..	(+)100.00(a)	
10,590	8,100	201. Research on Fodder Production, W.Bengal.	8,092.25	(+)7.75(a)	
6,000	..	202. Research on Fodder Production, Bihar.	..	..	
5,900	..	203. Research on Fodder Production, Mysore.	..	..	
5,440	1,100	204. Research on Fodder Production, Coorg (Mysore).	1,012.00	(+)88.00(a)	
7,000	1,000	205. Research on Fodder Production, Bhopal (M.P.)	937.50	(+)62.50(a)	
5,500	5,800	206. Research on Fodder Production, Andhra.	5,750.00	(+)50.00(a)	
12,270	3,700	207. Research on Fodder Production, Madras.	5,950.00	(—)2,250.00(g)	(g) Demand for funds received late during the year.

1	2	3	4	5	6	7	8	9
			Rs.	Rs.		Rs. nP.	Rs. nP.	
					(b) *Wheat and other Cereals*—(Concld.)			
			7,400	3,700	208. Cytogenitical Studies on Maize, Andhra Uty.	3,670.00	(+)30.00(a)	(a) Inconsiderable.
			10,000	5,000	209. Cytogenitics of leguminous Crops, Presidency College, Calcutta.	5,000.00	..	
			4,530	3,700	210. Cytogenetics of wild grasses, Madras.	3,700.00	..	
			5,250	10,300	211. Control of Wilt of Maize, Bihar.	10,212.00	(+)88.00(a)	
			6,100	..	212. Drought resistance in Wheat, M.P.	..	..	
					(c) *Millets and Pulses*			
			7,620	400	213. Pulse breeding Madhya Pradesh (Gwalior).	380.41	(+)19.59(a)	
			14,970	1,300	214. Hybrid Bajra, Bombay	1,260.00	(+)40.00(a)	
			8,000	7,200	215. Striga attack on Sorgham, Andhra.	7,186.52	(+)13.48(a)	
			15,000	9,000	216. Hybrid Combu, Madras.	9,000.00	..	

5,450	5,500	217. Diseases of Bajra, Anand Institute.	5,435.31	(+)64.69(a)
3,960	..	218. Investigation on the Pests of Pulses, Bombay.	..	--
..	5,000	219. Storage and Viability of Pollen grains, Delhi University.	4,970.00	(+)30.00(a)
5,100	..	220. Cytology of Indian Grasses, M. P.	..	..
10,050	..	221. Pulse Research, Assam	..	--
5,820	5,000	222. Improvement of Pulses, Andhra.	5,000.00	..
5,620	5,000	223. Pulse Breeding, W. Bengal.	5,000.00	--
..	3,200	224. Pulse Breeding, Assam	3,113.00	(+)87.00(a)
..	..	225. Pulse Breeding, Andhra	--	--
		(d) *Fruits*		
2,000	8,700	226. Horticulture Tharsa, Bombay.	8,605.48	(+)94.05(a)
..	4,200	227. Horticulture Tharsa, Assam.	4,167.35	(+)32.65(a)
14,570	7,800	228. Horticulture Tharsa, Orissa.	7,747.00	(+)53.00(a)
23,000	..	229. Horticulture Tharsa, H.P.	..	..

1	2	3	4	5	6	7	8	9
			Rs.	Rs.	(d) *Fruits*—(Contd.)	Rs. nP.	Rs. nP.	
			39,010	13,400	230. Orange Cultivation Coorg (Mysore).	13,586.00	(—)186.00(a)	(a) Inconsiderable.
			6,600	..	231. Virus diseases and other disorders of stone hill fruits D.S.B. College, Nainital U.P.	..	—	
			17,000	17,600	232. Banana Research, Madras.	17,572.00	(+)28.00(a)	
			11,300	9,800	233. Banana Research, Bombay.	9,749.00	(+)51.00(a)	
			20,700	15,700	234. Banana Research, West Bengal.	15,700.00	—	
			8,360	1,200	235. Banana Research, Andhra.	1,180.00	(+)20.00(a)	
			5,500	5,100	236. Citrus Manurial Trials, Punjab.	5,100.000	—	
			1,000	..	237. Remedial Measures against Sanjose Scale of Kashmir.	..	—	
			64,000	..	238. Establishment of Horticultural Plant Introduction Station at Saharanpur, U.P.	..	—	

2,440	2,400	239.	Cytogenetical Studies on Grapes and related wild Species, Madras.	2,400.00	..
4,230	2,800	240.	Investigation on root, rot limb breakage, Andhra.	2,800.00	..
4,760	..	241.	Twig-blight diseases of Orange, W. Bengal.	—	—
6,900	..	242.	Research on pine-apples, W. Bengal.	..	..
7,330	8,000	243.	Citrus root stock trials, Andhra.	7,906.00	(+)94.00(a)
65,000	23,900	244.	Coordinated Study for the application of growth regulating substances in horticulture, Punjab.	23,900.00	..
36,000	21,000	245.	Coordinated Study for the application of growth regulating substances in horticulture, Andhra.	21,000 .00	..
7,700	..	246.	Coordinated Study for the application of growth regulating substances in horticulture, I.C.C.C.	..	..
9,410	..	247.	Cytogenetical Investigation on fruit trees, Calcutta Uty.	..	..

1	2	3	4	5	6	7	8	9
			Rs.	Rs.	(d) *Fruit*—(Contd.)	Rs. nP.	Rs. nP.	
			..	100	248. Improvement of soil condition in spent-up orchards, U. P.	53.00	(+)47.00(a)	(a) Inconsiderable.
			14,940	..	249. Banana Research Kerala.	..	..	
			6,780	..	250. Improvement and Stabilization of off season bearing of Mango in Kanya Kumari, Madras.	..	..	
			4,000	3,500	251. Wilt disease of guava, W. Bengal.	3,490.00	(+)10.00(a)	
			9,200	100	252. Research in Fruits, Kashmir.	24.00	(+)76.00(a)	
			10,250	32,400	253. Investigation in die-back diseases of citrus, I.A.R.I.	32,370.00	(+)30.00(a)	
			94,660	66,700	254. Investigation in die-back disease of citrus, Coorg (Mysore).	66,675.50	(+)24.50(a)	
			43,980	44,800	255. Investigation in die-back diseases of citrus, Bombay.	44,710.00	(+)90.00(a)	

23,900	37,000	256.	Improvement of Date Palm, Punjab.	37,000.00	..
19,000	14,600	257.	Establishment of Fruit Research Station in Plains, U.P.	14,530.00	(+)70.00(a)
9,800	..	258.	Increase in yield of fruits and vegetables by Bee-pollination, Bombay.	..	..
2,000	2,500	259.	Training in Fruit and Vegetable Preservation, Andhra.	2,467.00	(+)33.00(a)
14,630	..	260.	Horti cultural investigations, U.P. (Chaubastia).	..	..
4,800	4,500	261.	Research on Cashewnuts, Andhra.	4,502.00	(—)2.00(a)
7,740	100	262.	Co-ordinated Scheme on the effect of Chemicals on the storage of Fruits and Vegetables, C.F.T.R.I.	7.21	(+)92.79(a)
6,000	4,800	263.	Research on Cashewnuts, Bombay.	4,798.00	(+)2.00(a)
7,600	..	264.	Bunchy top disease of Bananas, Travancore Cochin (Kerala).	..	..
3,000	800	265.	Improvement of Ber fruit, Saurashtra, Bombay.	740.00	(+)60.00(a)

1	2	3	4	5	6	7	8	9
			Rs.	Rs.		Rs. nP.	Rs. nP.	
					(d) *Fruits*—(Concld.)			
			3,300	..	266. Improvement of Ber fruit, V.P. (M. P.)	..	..	
			3,000	2,800	267. Improvement of Ber fruit, PEPSU (Punjab)	2,800.00	..	
			3,060	3,800	268. Improvement of Ber fruit, Ajmer, (Rajasthan).	3,740.00	(+)60.00(a)	(a) Inconsiderable.
			3,000	2,100	269. Improvement of Ber fruit, M.P.	2,031.78	(+)68.22(a)	
			9,850	12,700	270. Improvement of Ber fruittrees, PEPSU (Punjab).	12,700.00	..	
			2,000	1,300	271. Training in Fruit and Vegetable Preservation, M.P.	1,239.23	(+)60.77(a)	
			7,800	..	272. Improvement of Pineapple by application of growth regulating substances (Gauhati Uty.) Assam.	..	..	
			2,000	..	273. Fruit Preservation Hyderabad, (Andhra)	..	..	
			8,700	5,900	274. Research on pests of Vegetables and Fruit trees, Punjab.	5,900.00	..	

6,400	2,900	275.	Research on pests of citrus, Andhra.	2,890.00	(+)10.00(a)
11,730	5,700	276.	Investigation of fruit Pests, Andhra.	5,700.00	..
5,200	4,500	277.	Chlorosis of Banana, Bombay.	4,500.00	..
11,700	10,600	278.	Evolution of new varieties of Mango, grapes and citrus, Punjab.	10,600.00	..
4,000	3,600	279.	Physiological studies on factors governing root formation in cutting and layering of fruits, Calcutta Uty.	3,600.00	..
61,000	12,000	280.	Co-ordinated Scheme for the improvement of muskmelon and water melon, I.A.R.I.	12,000.00	..
8,270	..	281.	Research on Cashew-nuts, Mysore.	..	..
3,000	6,000	282.	Research on Cashew-nuts, Kerala.	6,000.00	..
8,990	..	283.	Control of Serious diseases of Gua, Ajmer (Rajasthan).	..	..
			e) *Vegetable*		
..	100	284.	Tuber Crops, Bombay.	15.50	(+)84.50(a)

1	2	3	4	5	6	7	8	9
			Rs.	Rs.		Rs. nP.	Rs. nP.	
					(e) *Vegetable*—(Contd.)			
			7,900	5,800	285. Tuber Crops, Bihar .	5,733.00	(+)67.00(a)	(a) Inconsiderable.
			..	100	286. Tuber Crops, Orissa .	89.00	(+)11.00(a)	
			..	1,300	287. Tuber Crops, Mysore .	1,309·00	(—)9.00(a)	
			3,700	4,100	288. Investigation on pests of Vegetable, Andhra.	4,100.00	..	
			5,200	2,700	289. Tuber Crops, Madras.	2,700.00	..	
			..	..	290. Tuber Crops, Andhra.	1.00	(—)1.00(a)	
			..	900	291. Tuber Crops and related plants, T. University.	834.00	(+)66.00(a)	
			5,580	4,100	292. Tapioca and Sweet Potato, Travancore Cochin, Kerala.	4,096.60	(+)3.40(a)	
			11,200	9,100	293. Improvement of Vegetables, Bombay.	9,060.00	(+)40.00(a)	
			16,000	10,700	294. Improvement of Vegetables, U.P.	10,646.00	(+)54.00(a)	
			11,000	9,800	295. Improvement of Vegetables, Pepsu(Punjab).	9,756.82	(+)43.18(a)	
			6,840	3,900	296. Onion Research, Andhra.	3,842.14	(+)57.86(a)	

4,150	3,900	297.	Improvement of Onion and garlic, W. Bengal.	3,900.00	..
11,600	7,600	298.	Vegetable Research Station, Andhra.	7,600.00	..
13,800	13,000	299.	Improvement of Vegetables, Madras.	13,000.00	..
11,700	100	300.	Improvement of Vegetables, Kashmir.	82.40	(+)17.60(a)
3,000	5,300	301.	Improvement of Vegetables, Punjab.	5,250.07	(+)49.93(a)
11,200	9,200	302.	Improvement of Vegetables, Hyderabad (Andhra).	9,150.00	(+)50.00(a)
17,080	10,000	303.	Improvement of Vegetables, West Bengal.	9,950.00	(+)50.00(a)
9,600	8,200	304.	Improvement of Vegetables, M.P.	8,162.06	(+)37.94(a)
7,780	..	305.	Improvement of Vegetables, V.P. (M.P.)	..	..
8,600	..	306.	Improvement of Vegetables, H.P.	—	—
			(f) *Other Crops*		
10,700	10,100	307.	Chillies Research, I. A. R.I.	10,030.00	(+)70.00(a)
5,000	..	308.	Chillies Research, Mysore	..	..
5,000	..	309.	Chillies Research, Madras.	..	..

1	2	3	4	5	6	7	8	9
			Rs.	Rs.		Rs. nP.	Rs. nP.	
					(f) *Other Crops*—(Contd.)			
			..	200	310. Research on pests and disease of Cashewnut, Madras.	104.00	(+)96.00(a)	(a) Inconsiderable.
			..	100	311. Cardamoms, Madras .	22.88	(+)77.12(a)	
			9,500	7,900	312. Cardamoms, W. Bengal	7,900.00	..	
			7,000	19,500	313. Pepper, Kerala . .	19,475.00	(+)25.00(a)	
			4,000	..	314. Ginger, Madras .	451.04	(—)451.04(g)	(g) Demand for funds received late during the year.
			7,000	3,600	315. Zira diseases, Rajasthan	3,543.39	(+)56.61(a)	(a) Inconsiderable.
			27,080	..	316. Medicinal Plants, Assam.	..	..	
			17,200	15, 0	317. Medicinal Plants, F.R.I.	15,470.00	(+)30.00(a)	
			10,200	17,000	318. Medicinal Plants, Kashmir.	17,000.00	..	
			13,000	..	319. Medicinal Plants, West Bengal.	..	..	
			13,500	..	320. Medicinal Plants, H.P.	..	..	

..	9,600	321.	Research cum Extension on Bee Keeping Industry, I.A.R.I.	—	(+)9,600(B)	(B) Amount of Rs. 9,540 refunded to the Govt. of India shown under separate head.
2,000	1,700	322.	Cultivation and development of Ginger Travancore Cochin, (Kerala).	1,200·00	(+)500·00(a)	(a) Inconsiderable.
7,150	4,900	323.	Spices, W. Bengal	4,900·00	—	
10,800	6,900	324.	Cloves Nutmeg and Coco, Madras.	6,817·00	(+)83.00(a)	
8,800	1,200	325.	Turmeric Research (Revised) Orissa.	1,146.66	(+)53.34(a)	
1,30,000	66,200	326.	Botanical improvement of the essential oil yielding plants, I.A.R.I.	66,130·00	(+)70.00(a)	
4,900	..	327.	Coordinated Scheme for Control of Katee diseases of Cardamom, Madras.	—	—	
3,780	..	328.	Coordinated Scheme for Control of Katee diseases of Cardamom, Bombay (Mysore).	—	—	
6,000	..	329.	Coordinated Scheme for Control of Katee diseases of Cardamom, Travancore-Cochin (Kerala).	—	—	

1	2	3	4	5	6	7	8	9
			Rs.	Rs.		Rs. nP.	Rs. nP.	
					(f) *Other Crops*—(Contd.)			
			5,100	9,100	330. Coordinated Scheme for Control of Katee diseases of Cardamom, Mysore.	9,070.00	(+)30.00(a)	
			2,000	..	331. Coordinated Scheme for Control of Katee diseases of Cardamom, I. A. R. I. (for T. A. only).	..	..	
			24,000	20,100	332. Establishment of a research station for cardamom (Kerala).	20,092.92	(+)7.08(a)	
			19,100	..	333. Establishment of a research station for cardamom, Mysore.	46,745.00	(—)46,745.00	
			..	30,000	334. Research on pests and diseases of cashewnut plantation, Mysore.	..	(+)30,000.00 (b)	(b) Demand for funds not received during the year.
			30,730	19,000	335. Establishment of Research Station of Pepper, (Kerala).	19,000.00	..	
			6,600	4,900	336. Turmeric, Andhra	4,810.00	(+)90.00(a)	(a) Inconsiderable.
			6,000	5,000	337. Ginger, Assam	4,918.12	(+)81.88(a)	

6,100	..	338.	Ergot Production, West Bengal.	..	..
3,700	4,000	339.	Ergot Production, Assam.	3,992·95	(+)7.05(a)
15,000	30,000	340.	Composite Research Station for Pepper and Cardamom and Cashewnut, Assam.	30,000·00	..
12,560	..	341.	Scheme for deputation of an Officer to East Asian Countries for collecting fresh hand information on cultivation and manurial practices of Pepper, Kerala.	..	..
4,500	3,900	342.	Chillies, West Bengal	3,850·00	(+)50.00(a)
4,500	900	343.	Chillies, M. P.	880·00	(+)20.00(a)
6,300	5,300	344.	Chillies, Andhra	5,250·00	(+)50.00(a)
4,600	4,200	345.	Chillies, Hyderabad	4,110·00	(+)90.00(a)
24,000	..	346.	Improvement of Poppy, I.A.R.I.	..	..
8,000	..	347.	Control of Hairy Caterpillars of Cardamom, Mysore.	..	..
7,300	5,300	348.	Improvement of Lemon grass, Kerala.	5,300.00	..
3,000	..	349.	Research on Pepper and Cardamom, Orissa.	..	..

1	2	3	4	5	6	7	8	9
			Rs.	Rs.		Rs. nP.	Rs. nP.	
			3,000	1,700	350. Research on Pan, Madhya Pradesh.	1,646.89	(+)53.11(a)	(a) Inconsiderable
			19,110	..	351. Scheme for research and development of Vanilla Cultivation, Kerala.	..	..	
			11,930	..	352. Cultivation of Camphor in Wynad, Kerala.	..	..	
			11,950	..	353. Establishment of betevine Research station in Cuddapa, Andhra.	..	..	
			1,020	..	354. Scheme for Cultivation of Medicinal Plants in cinchona plantations, Madras.	..	..	
..	..		10,070	..	355. Research on Turmeric ginger and elephant foot in Punjab.	..	..	
			5,650	..	356. Ginger Research Scheme in Himalyan Areas, West Bengal.	..	..	
			3,000	..	357. Ginger Research Scheme in Himalyan Areas, Madras.	..	..	

7,000	6,800	358. Root Crops, West Bengal.	6,800	.. ..	
9,600	7,800	359. Spices, Delhi University.	7,710.00	(+)90.00(a)	
..	2,000	360. Research in Pan, Madras.	2,000.00	..	
		(g) *Soils and Manures*			
5,000	6,500	361. Micronutrients studies, Punjab.	6,411.22	(+)88.78(a)	
37,560	14,300	362. Collection of Soil Survey, I.A.R.I.	14,300.00	..	
12,500	7,500	363. Usarland Reclamation, Punjab.	7,406.31	(+)93.69(a)	
14,000	19,700	364. Soil Standardisation method, Bombay.	19,610.00	(+)90.00(a)	
1,790	..	365. Soil and plant growth, Agra.	447.00	(—)447.00(b)	(b) Demand for funds received late during the year.
..	..	366. Nitrogen fixation in soils, Madhya Pradesh.	(—)369.00	(+)369.00(a)	(a) Inconsiderable.
18,000	10,400	367. Folian application of nutrient to crops, I.A.R.I.	10,310·00	(+)90.00(a)	
12,000	5,500	368. Study of fertility index of soils field Research station, Bombay.	5,486.05	(+)13.95(a)	

1	2	3	4	5	6	7	8	9
					(g) *Soils and Manures* (Contd.)			
			Rs.	Rs.		Rs. nP.	Rs. nP.	
			16,000	..	369. Investigation of Kharland in Bombay State, Bombay.	..	..	
			20,000	..	370. Reclamation of saline soils, West Bengal.	..	..	
			10,500	5,100	371. Biological approach for reclamation of saline and alkaline soils, Madras.	5,078.00	(+)22.00(a)	(a) Inconsiderable.
			..	2,500	372. Methods and Practices of farming in States, Himachal Pradesh.	2,410.00	(+)90.00(a)	
			5,000	3,700	373. Manurial Experiments on Paddy lands, West Bengal.	3,650.00	(+)50.00(a)	
			4,800	4,200	374. Salinity Research Scheme, B. R. College, Agra.	4,200.00	..	
			5,200	4,700	375. Nitrogen Fixation in Soil, Sheila Dhar Institute.	4,700.00	..	
			2,400	..	376. Green manure, Uttar Pradesh.	..	..	

9,000	9,000	377.	Studies in the cost of reclamation of Kalar (Alkali) lands, Khalsa College, Amritsar, Punjab.	8,912.00	(+)88.00(a)
5,000	..	378.	Possibilities of using carbons in improvement and reclamation of soils, Punjab University.	..	..
2,570	3,600	379.	Green manuring Crops, Bihar.	3,540.00	(+)60.00(a)
3,000	..	380.	Green manuring Crops, I.C.J.C.	..	..
10,000	8,400	381.	Alkali Reclamation, Andhra.	8,359.00	(+)41.00(a)
4,500	4,000	382.	Clay mineral Contents of Indian Soil, W. Bengal.	3,950.00	(+)50.00(a)
7,730	..	383.	Soil Conditioners, W. Bengal.	..	..
4,300	3,100	384.	Legume seed inoculation, W. Bengal.	3,100.00	..
5,200	5,600	385.	Nitrogen Fixation, Andhra.	5,540.00	(+)60.00(a)
75,000	..	386.	Usar land reclamation, Lucknow.	..	..
18,600	13,000	387.	Composition of plants in usar lands—Lucknow Uty.	13,000.00	..

1	2	3	4	5	6	7	8	9
					(g) *Soils and Manures* (Contd.)			
			Rs.	Rs.		Rs. nP.	Rs. nP.	
			5,000	4,900	388. Phosphatic reversion in Nilgiries, Madras.	4,880.00	(+)20.00(a) (a)	Inconsiderable.
			22,000	39,600	389. Examining the behaviour of certain additional chemical fertilizers, I.A.R.I.	39,600.00	..	
			60,000	..	390. Saline and alkaline control in Punjab soils, Punjab.	..	..	
			6,000	..	391. Soil structure in Punjab soils, Punjab.	..	..	
			7,500	..	392. Reclamation of Saline and Alkaline Lands, Madras.	..	..	
			3,500	3,000	393. Phosphorus Nutrition of crops, Andhra.	2,960.00	40.00	
			6,000	4,300	394. Nitrogen fixation, Bombay.	4,300.00	..	
			1,480	..	395. Simple Fertilizer trials, Nilokheri.	—	..	
			—	100	396. Simple Fertilizer trials, Mangalore, (Mysore).	43.00	(+)57.00(a)	
			360	..	397. Simple Fertilizers trials Orissa, Bhuvaneshwar	..	..	

1,000	..	398. Simple Fertilizer trials, Bombay.	..	..
880	..	399. Simple Fertilizer trials, Bangalore (Mysore).	..	..
440	..	400. Simple Fertilizer trials, Madras.	..	..
1,060	..	401. Simple Fertilizer trials, I.A.R.I.	..	..
400	32,600	402. Simple Fertilizer trials, Bihar.	32,600.00	..
1,850	..	403. Simple Fertilizer trials, Hyderabad (Andhra).	..	..
2,300	..	404. Simple Fertilizer trials, U.P.	..	..
270	..	405. Simple Fertilizer trials, W. Bengal.	..	..
2,810	..	406. Model Agronomic Experiments Hyderabad (Mysore), Gangawati Centre.	..	—
810	2,600	407. Model Agronomic Experiments, Madras.	2,550.00	(+)50.00(a)
..	5,600	408. Model Agronomic Experiments, (Bombay) (Karjat & Lakhampur).	5,558.00	(+)42.00(a)
..	4,500	409. Model Agronomic Experiments, Assam.	4,421.00	(+)79.00(a)

APPENDIX X—(*Contd.*)

1	2	3	4	5	6	7	8	9
					(g) *Soils and Manures*—Contd.			
			Rs.	Rs.		Rs. nP.	Rs. nP.	
			370	6,500	410. Model Agronomic Experiments, Punjab (Nasirpur).	6,414.00	(+)86.00(a)	(a) Inconsiderable.
			..	15,300	411. Model Agronomic Experiments, Punjab (Sirsa).	15,284.19	(+)15.81(a)	
			570	..	412. Model Agronomic Experiments, M.P.	..	..	
			130	100	413. Model Agronomic Experiments, Andhra, (Chimagonehal).	8.00	(+)92.00(a)	
			430	..	414. Model Agronomic Experiments, Kerala.	..	..	
			490	..	415. Model Agronomic Experiments, Orissa.	..	..	
			1,360	..	416. Model Agronomic Experiments, M,P. (Bhopal).	..	..	
			650	..	417. Model Agronomic Experiments, Agra (U.P.).	..	..	
			..	300	418. Model Agronomic Experiments, Umrala (Bombay).	264.40	(+)35.60(a)	

..	2,500	419.	Model Agronomic Experiments, Mysore (Virapura).	2,408.00	(+)92.00(a)
3,100	..	420.	Model Agronomic Experiments, Andhra Pradesh (Maruteru).	..	..
7,920	..	421.	Green Manuring Crops, H.P.	..	..
4,000	3,400	422.	Green Manuring Crops, Hyderabad (Andhra).	3,326.00	(+)74.00(a)
3,000	..	423.	Green Manuring Crops, Mysore.	..	..
8,000	6,500	424.	Micronutrient studies of soils, Bombay.	6,467.50	(+)32.50(a)
5,200	5,200	425.	Usar and relcamation Sheilladhar Institute.	5,150.00	(+)50.00(a)
..	1,600	426.	Studies in microflora of soils, I.I.Sc. Bangalore.	1,586.00	(+)14.00(a)
..	13,200	427.	Manurial Experiments, Pepsu, Punjab.	13,146.00	(+)54.00(a)
..	3,200	428.	Manurial Experiments, West Bengal.	3,194.12	(+)5.88(a)
8,000	6,500	429.	Intake of different farms of phosphate by Green manuring Crops, Madras.	6,481.00	(+)19.00(a)
5,000	..	430.	Standardization of methods for determining.		

1	2	3	4	5	6	7	8	9
			Rs.	Rs.	(g) *Soil and Manures*—Contd.	Rs. nP.	Rs. nP.	
					1. Surface area and 2. P. M. value of soil, Punjab University.	..	..	
					(h) *Agronomy*			
			..	1,200	431. Water requirements of crops at Central Field Research Station, Poona.	1,170.00	(+)30.00(a)	(a) Inconsiderable.
			15,900	37,600	432. Agronomic aspects of Jowar, Amravati, M.P.	37,556.00	(+)44.00(a)	
			11,000	..	433. Sprinkling irrigation, Coorg (Mysore).	..	..	
			9,000	9,100	434. Agronomic aspects of green manuring, Bombay.	9,014.03	(+)85.97(a)	(a) Inconsiderable.
			9,500	..	435. Water requirement of Crops, D.V.C.	..	..	
					(i) *Physiology*			
			5,610	4,200	436. Physiology of Rice flowering, West Bengal.	4,200.00	..	
			9,670	7,000	437. Rice Physiology, Calcutta University.	7,000.00	..	

5,200	..	438. Storage and viability of pollen grains, Delhi Uty.	..	—	
15,510	13,000	439. Use of phytohormones for higher yields, Bombay.	13,000.00	..	
9,190	4,300	440. Chemical Stimulation of ovules, Delhi Uty.	4,270.00	(+)30.00	
57,100	46,300	441. Plant physiology and Sub-station Plant introduction bureau, Vivekanand Laboratory, U.P.	46,256.45	(+)43·55(a)	
		(j) *Entomology*			
14,000	3,600	442. Intensification of Termite Research, Anand.	5,600.00	—	
2,400	2,400	443. Investigating the use of distress called of birds feeding of grain Crops, Bombay.	2,400.00	—	
11,000	3,000	444. Nutritional and Biological studies of Insects, I.A.R.I.	3,000.00	..	
11,000	700	445. Systematic and Biological studies of ardent fauna Delhi Uty.	5,380.00	(—)4,680.00(g)	(g) Demand for funds received very late during the year.
10,500	6,100	446. Augmenting the marmed insect collection, Agriculture College, Coimbatore.	6,020.00	(+)80.00(a)	(a) Inconsiderable.

1	2	3	4	5	6	7	8	9
			Rs.	Rs.		Rs. nP.	Rs. nP.	
					(j)—*Entomology*—(Contd.)			
			8,480	7,300	447. Physiological relationship between insect and their host plants, Delhi Uty.	7,280.00	(+)20.00(a)	(a) Inconsiderable.
			14,840	12,600	448. Termite and research scheme (Taxonomy), Zoological Survey of India, Calcutta.	12,530.00	(+)70.00(a)	
			5,240	5,000	449. Study of the rates of decomposition of insecticides deposits, Osmania Uty., Hyderabad.	5,000.00	..	
			12,800	3,000	450. Research on fungicides, I.A.R.I.	3,000.00	..	
			4,800	..	451. Research on fungicides, Punjab.	..	..	
			6,700	..	452. Research on fungicides, Poona (Bombay).	..	..	
			5,500	3,500	453. Research on fungicides, Coimbatore (Madras).	3,490.00	(+)10.00(a)	
			6,000	..	454. Research on fungicides, West Bengal.	..	..	

35,000	17,800	455.	Exploration of Toxicity hazards in the use of modern insecticides, I.A.R.I.	17,749.27	(+)50.73(a)
43,000	..	456.	Exploration of Toxcity hazards in the use of Modern insecticides of cattle and human beings, I.V.R.I.	..	..
5,600	5,200	457.	Scheme for studies on Aphidae, W. Bengal.	5,200.00	..
7,100	..	458.	Work on bioessay and other techniques in the study of plant diseases, Madras Uty.	..	..
3,200	4,100	459.	Research on toxicity and adverse effect of Synthetic pesticides, Madras.	4,060.00	(+)40.00(a)
--	200	460.	Weed Control Poona, Bombay.	164.00	(+)36.00(a)
..	100	461.	Weed Control Madras, Madras.	46.00	(+)54.00(a)
..	1,800	462.	Weed Control, B. R. College, Agra.	1,790.00	(+)10.00(a)
4,500	4,100	463.	Control of nematodes on betelvine in Nasik District, Bombay.	4,060.00	(+)40.00(a)
15,140	5,400	464.	Termite Research, F.R.I.	5,380.00	(+)20.00(a)
11,000	9,100	465.	Termite Research, I.A.R.I.	9,069.78	(+)30.22(a)

1	2	3	4	5	6	7	8	9
			Rs.	Rs.		Rs. nP.	Rs. nP.	
					(j)—*Entomology*—(Contd.)			
			..	2,600	466. Test with D.D.T., Bombay.	2,509.00	(+)91.00(a)	(a) Inconsiderable.
			5,480	3,500	467. Building up named reference collection of insect pests at the Agricultural College, Baptala (Andhra).	3,480.00	(+)20.00(a)	
			27,500	27,500	468. Fundamental research on toxcity and mode of action of insecticides, Punjab University College, Hoshiarpur.	27,420.00	(+)80.00(a)	
				..	(k)—*Mycology*			
			7,700	..	469. Development of Heribarium cry togamal orientals, I.A.R.I	..	..	
			28,200	32,800	470. Co-ordinated Plant Virus Scheme, Eastern Zone, I.A.R.I.	32,732.38	(+)67.62(a)	
			5,000	3,900	471. Control of Budha Parasite, B. R. College, Agra.	3,840.00	(+)60.00(a)	

(l)—*Floriculture*

28,990	29,800	472.	Cytogenitical & Physiological Studies in relation to floriculture, I.A.R.I.	29780.00	(+)20.00(a)
11,800	..	473.	Research and development on floriculture, Punjab (PEPSU).	..	..

(m)—*General*

710	..	474.	Survey of Fertilizer Practices, U.P.	..	..
15,000	13,700	475.	Studies of genetics and Variability of Algae, I.A.R.I.	13,614.72	(+)85.28(a)
20,000	3,800	476.	Pre-soaking seed in Nutrient Salt, Indore.	3,756.20	(+)43.80(a)
4,480	3,600	477.	Pre-soaking seed in Nutrient Salt, Vivekananda Laboratory, Almora.	3,506.00	(+)94.00(a)
7,190	8,000	478.	Pre-soaking seed in Nutrient Salt, I.A.R.I.	8,000.00	..
1,300	..	479.	Survey of fertilizer practices, Punjab.	..	..
2,800	..	480.	Survey of fertilizer practices, M. P.	..	..
..	1,000	481.	Investigation into methods of practices of farming, Bihar.	1,000	..

1	2	3	4	5	6	7	8	9
			Rs.	Rs.		Rs. nP.	Rs. nP.	
					(ii)—Animal Husbandry			
					(a) *Cattle Breeding*			
			30,000	13,200	482. Livestock Investigation, Punjab.	13,158.54	(+)41.46(a)	(a) Inconsiderable.
			29,970	10,600	483. Immune Genetic of Indian Cattle, I. V. R. I.	10,600.00	..	
			35,000	38,200	484. Fundamental study of quantitative inheritance, I.V.R.I.	38,200.00	..	
			40,000	35,300	485. Improvement of Kangayam breed, Madras.	35,260.00	(+)40.00(a)	
			70,000	25,300	486. Causes of degeneration of Indian Cattle, I.V.R.I.	25,280.00	(+)20.00(a)	
			40,000	..	487. Comparative Study of selective breeding of Purnea, Bihar.	..	..	
			45,000	47,000	488. Selective breeding and grading up of cattle, West Bengal.	46,961.89	(+)38.11(a)	

12,000	8,700	489.	Thickness of skin and distribution of sweat glands of buffaloes in relation to milk production, I.V.R.I.	8,700.00	..
1,00,000	..	490.	Camel Farm for the Bikaneri breed and opening of 10 Key Village Centres, Rajasthan.	..	..
..	29,000	491.	Estimation of Milk sucked by Calves in unwanted herds, Anand.	29,000.00	..
24,000	..	492.	Evolving a new type of pigs by cross breeding, U.P.	..	..
15,000	9,800	493.	Evolving methods of sterlization of scrub cows, I.V.R.I.	9,800.00	..
35,000	24,100	494.	Evolving suitable draught capacity measure for bullocks, I.V.R.I.	24,040.00	(+)60.00(a)
45,000	20,100	495.	Selective breeding and grading up of cattle (Kaira type), Orissa.	20,320.00	(—)220.00(a)
980	..	496.	Metabolic effects of harmones in relation to induced loctation, U.P.	..	—
30,000	16,900	497.	Relative value o selective breeding and grading up of unblachery cattle, Madras.	16,830.00	(+)70.00(a)

1	2	3	4	5	6	7	8	9
					(a) *Cattle Breeding*—(contd.)			
		Rs.	Rs.			Rs. nP.	Rs. nP.	
		6,000	..	498.	Determining the age maturity of Indian Bulls, Orissa.	...	..	
		25,000	12,700	499.	Rearing on sex behaviour of breeding of bulls, Madras.	12,700.00	..	
		28,000	..	500.	Rearing on sex behaviour of breeding of bulls, N.D.R.I.	..	..	
		1,000	..	501.	Physiology of hump development and sheath of cattle, Veterinary College Calcutta, Bengal.	...	...	
		..	15,900	502.	Rearing on sex behaviour of breeding of bulls, Mysore.	15,900.00	...	
		2,00,000	..	503.	Rearing on sex behaviour of breeding of bulls, Other centres.	...	...	
		80,000	47,000	504.	Physiological Genetics of Cattle, West Bengal.	46,960.00	(+)40.00(a)	(a) Inconsiderable.

35,450	14,200	505. Selective breeding and grading up of indigenous cattle, Orissa.	14,180.00	(+)20.00(a)
52,600	..	506. Cattle Breeding Research, H. P.	..	..
..	25,000	507. Co-ordinated Cattle Sterility, I.V.R.I.	25,000.00	..
11,000	..	508. Co-ordinated Cattle Sterility, Assam.	..	..
11,000	..	509. Co-ordinated Cattle Sterility, Orissa.	..	..
25,000	31,600	510. Co-ordinated Cattle Sterility, Osmania Uty.	31,600.00	..
14,000	..	511. Co-ordinated Cattle Sterility, M.P.	..	..
17,000	35,900	512. Artificial Insemination, I.D.R.I.	35,890.00	(+)10.00(a)
40,000	..	513. Progeny Testing of Murrah Buffaloes, Bulls, Bombay.	..	..
2,00,000	..	514. Investigations on the Progeny testing of Bulls under Indian Conditions 2 units.	..	..
20,000	9,800	515. Cross breeding of Cattle, Andhra.	9,720.00	(+)80.00(a)
20,000	..	516. Cross breeding of Cattle, Assam.	..	..

1	2	3	4	5	6	7	8	9
					(a) *Cattle Breeding*—(contd.)			
			Rs.	Rs.		Rs. nP.	Rs. nP.	
			20,000	12,000	517. Cross breeding of Cattle, Madras.	12,000.00	..	
			16,000	..	518. Cross breeding of Cattle, Bihar.	..	..	
			..	8,200	519. Central Artificial Insemination sub-station, Calcutta.	8,200.00	..	
			13,000	11,100	520. Cross breeding of Cattle, U.P.	11,100.00	..	
			23,000	14,200	521. Cross breeding of Cattle, West Bengal.	14,140.00	(+)60.00	
			86,050	..	522. Selective Breeding V. S. grading up of Marthvada Buffaloes, Andhra (Hyderabad).	...	..	
			15,000	28,000	523. Cross Breeding of Cattle, Punjab.	28,000.00	..	
			18,000	12,500	524. Cross Breeding of Cattle, Kerala.	12,500.00	..	
			25,000	..	525. Cross breeding of local non-descript cattle, Andhra.	..	..	

12,000	6,900	526. Cross Breeding of Cattle in heavy rainfall areas (Neyyatmkara Centre), Kerala.	6,900.00	..	
22,000	3,100	527. Scheme for investigation of the possibility of spreading out the breeding season in Buffaloes, I.V.R.I.	3,100.00	..	
48,900	..	528. Cross Breeding of Cattle in hilly and heavy rainfall areas, Mysore.	..	..	
40,000	38,000	529. Scheme for investigating the Comparative value of grading up with Sindhy Bulls and Cross breeding with Jersey Bulls for increased milk production, Kerala.	38,000.00	..	
		(b) *Goat and Sheep Breeding*			
10,000	..	530. Development of mutton breeds of Sheep, Bombay.	..	..	
8,000	..	531. Development of mutton breeds of Sheep, Chingleput, Madras.	..	..	
10,000	2,200	532. Indigenous Goat breeding, Punjab.	2,130.00	(+)70.00(a)	(a) Inconsiderable.
2,150	..	533. Indigenous Goat breeding, U.P.	..	..	

1	2	3	4	5	6	7	8	9
				(b) *Goat and Sheep Breeding*—(contd.)				
		Rs.	Rs.			Rs. nP.	Rs. nP.	
		21,910	...	534.	Sheep research Station, Punjab.	..	..	
		8,000	..	535.	Meat and Mahir goat, Bombay.	..	..	
		31,880	..	536.	Establishment of research units of sheep production in mixed farming, Madras.	..	..	
		8,180	8,000	537.	Angora Goat Breeding, U.P.	8,000.00	..	
		6,400	4,900	538.	Improvement of sheep in Hills, West Bengal.	4,900.00	..	
		3,040	6,000	539.	Improvement of goat, Kerala.	5,951.98	(+)48.02(a)	(a) Inconsiderable.
		12,000	8,900	540.	Improvement of goat, West Bengal.	8,850.00	(+)50.00(a)	
		10,000	..	541.	Exploring the possibilities of Mohir Production, Andhra.	..	..	

10,000	..	542. Development of mutton breeds of Sheep, Andhra.	..	..	
600	..	543. Definition of breeds of Sheep, Rajasthan.	..	..	
25,000	22,400	544. Sheep and wool improvement on regional basis, U. P.	22,355.00	(+)45.00(a)	
..	800	545. Sheep and wool improvement on regional basis, Bombay (Joria centre).	708.36	(+)91.64(a)	
..	..	546. Sheep and wool improvement on regional basis, Poona.	6,513.00	(—)6513.00(g)	(g) Demand for funds received late.
8,260	..	547. Sheep and wool improvement on regional basis, Bihar.	..	..	
26,370	15,000	548. Sheep and wool improvement on regional basis, Madras Revised.	15,000.00	..	
6,050	..	549. Developing strains of goats for Mohar production, Himachal Pradesh.	..	..	
30,000	200	550. Sheep and wool improvement on regional basis, Rajasthan.	138.00	(+)62.00(a)	(a) Inconsiderable.
35,000	800	551. Sheep and wool improvement on regional basis, H.P.	708.36	(+)91.64(a)	

1	2	3	4	5	6	7	8	9
					(*b*) *Goat and Sheep Breeding*—(contd.)			
		Rs.	Rs.			Rs. nP.	Rs. nP.	
		..	5,800	552.	Sheep and wool Improvement on regional basis, Jammu and Kashmir.	5,716.71	(+)83.29(a)	Inconsiderable.
		40,000	..	553.	Sheep and wool Improvement on regional basis, (Revised).	..	..	
		14,300	..	554.	Sheep and wool Improvement on regional basis, Mysore.	..	..	
		30,000	..	555.	Sheep and wool Improvement on regional basis, Bombay(Poona).	..	..	
		23,000	..	556.	Development strains of goats for milk Production, Bombay.	..	..	
		3,000	5,000	557.	Normal worm Burden in Sheeps and Wool, Punjab.	5,000.00	..	
					(c) *Animal Nutrition*			
		26,800	..	558.	Animal nutrition, Punjab.	..	..	
		70,000	82,500	559.	Animal nutrition, Bombay.	82,474.60	(+)25.40(a)	

1,57,920	57,800	560.	Animal nutrition, I.D.R.I.(Bangalore).	57,800.00	..
40,000	31,200	561.	Animal nutrition, West Bengal.	31,200.00	..
33,000	23,400	562.	Utilization of waste products for feeding of cattle, Orissa.	23,390.00	(+)10.00(a)
65,800	26,300	563.	Urea as a protein substitute, I.V.R.I.	26,300.00	..
60,750	16,400	564.	Influence of trace elements on the health and production capacity of Livestock, I.V.R.I.	16,400.00	..
65,000	32,700	565.	Further work on Paddy straw, I.V.R.I.	32,700.00	..
20,000	9,600	566.	Nutrition requirement of buffaloes, Agra.	9,515.00	(+)85.00(a)
8,000	..	567.	Survey of the deficiency disease of Livestock, W. Bengal.	..	..
40,000	6,700	568.	Studies on food requirements of sheep under range and agricultural conditions, I.V.R.I.	6,700.00	..
10,210	5,000	569.	Co-ordinating Officer Animal Nutrition, I.V.R.I.	5,000.00	..

1	2	3	4	5	6	7	8	9
					(c) *Animal Nutrition* —(contd.)			
		Rs.	Rs.			Rs. nP.	Rs. nP.	
		15,000	..	570.	Animal Nutrition Stations provision for Jeeps etc. (to be allotted to various centres.).	..	..	
		30,000	..	571.	Scheme on the investigation on the nutritional requirements of pigs, I.V.R.I.	..	..	
		28,000	..	572.	Investigation on the quality of wool and meat in relation to nutrition of sheep, B. R. College, Agra.	..	..	
					(d) *Animal Pests Diseases and Cure*			
		6,000	3,400	573.	Veterinary investigation Officer (Cattle), Kerala.	3,370.00	(+)30.00(a)	(a) Inconsiderable.
		6,000	4,100	574.	Veterinary investigation Officer (Cattle), (Pepsu) Punjab.	4,104.00	(—)4.00(a)	
		6,000	..	575.	Veterinary investigation Officer (Cattle), Saurashtra & Kutch.	..	..	
		10,000	..	576.	Veterinary investigation Officer (Cattle), Rajasthan.	..	..	

7,520	..	577.	Veterinary investigation Officer (Cattle), Mysore.	.	..	
6,000	..	578.	Sheep and goat diseases, Rajasthan.	..	..	
50,000	23,600	579.	Investigating the possibilities of large scale manufacture of M. S. Adjutant Vaccine, I. V.R.I.	23,600.00	..	
4,960	5,000	580.	Investigation of the use of stabiliser in Rinderpest and Ranikhet Vaccine, U. P.	5,000.00	..	
7,500	6,300	581.	V. I. O. (Sheep and Goats), U.P.	2,260.00	(+)40.00(a)	
3,700	3,300	582.	A. D. I. O. Piggs, Punjab.	3,280.00	(+)20.00(a)	
6,470	4,100	583.	Manufacture of Virus Vaccine, Madras.	6,100.00	(—)2,000.00(h)	(h) Demand for funds includes previous ar rears.
4,360	..	584.	Asstt. Disease investigation Officer (Camels), Punjab.	..	..	
4,890	3,000	585.	Improvement of Vaccine, Madras.	3,000.00	..	
7,990	3,200	586.	Bacteriological flora of bovine genetalia, Orissa.	3,140.00	(+)60.00(a)	(a) Inconsiderable.

1	2	3	4	5	6	7	8	9
		Animal (d) *Pests Diseases and cure*—(contd.)						
		Rs.	Rs.			Rs. nP.	Rs. nP.	
		2,000	..	587.	Monograph of Helminth Parasites of the domesticated animals in India, I. V. R. I.	..	..	
		45,000	..	588.	Scheme to study keeping quality of Veterinary biological products, I.V.R.I.	..	..	
		6,890	..	589.	Toxic plants and herbs lethel to domestic animals , W. Bengal.	..	..	
		3,000	..	590.	Studies on the life history and bionomics of Ery Trema etc., W. Bengal.	..	..	
		17,000	8,100	591.	Control of Brucellosis Madras.	8,100.00	..	
		8,000	..	592.	Control of Brucellosis, Orissa.	..	..	
		14,000	14,200	593.	Rabbies Research and Diagnestic Centre, I.V.R.I.	14,200.00	..	
		32,540	..	594.	Parasitic disease Mysore.	..	..	

9,250	..	595. Fluke disease of bovine, Mysore.	..	..	
18,000	24,000	596. Investigation of infectious abortion (Brucellosis), U.P.	24,000.00	..	
20,000	..	597. Liver fluke and other parasitic infection of livestock, Bihar.	..	..	
5,500	13,000	598. Control eradicating of stephonofill arises among cattle Humpsone Scheme, Orissa.	1,300.00	(+)11,700(k)	(k) Less demand for fund received than anticipated during the year.
1,150	..	599. Control eradicating of stephonofill arises among cattle Humpsone Scheme, Assam.	..	..	
10,080	..	600. Control eradicating of stephonofill arises among cattle Humpsone Scheme, W. Bengal.	..	..	
20,000	..	601. Studies on micotic diseases in domestic animal in India, W. Bengal.	..	..	

1	2	3	4	5	6	7	8	9
					(d) *Animal Pests diseases and cure*—(contd.)			
		Rs.	Rs.			Rs. nP.	Rs. nP.	
		5,200	..	602.	Study of germicidal action of certain well-known medicinal plants, W. Bengal.	..	..	
		9,000	7,300	603.	Biology and systematics of hill leeches, Delhi Uty.	7,280.00	(+)20.00(a)	(a) Inconsiderable
		..	20,200	604.	Tuberculin testing, Bihar.	20,105.00	(+)95.00(a)	
		7,000	..	605.	Cocidal flora of Cattle, Bombay.	..	..	
		32,000	28,200	606.	Bearing of nutrition on helminthic infection, I.V.R.I.	28,200.00	..	
		.	16,000	607.	Bearing of nutrition on helminthic infection I.V.R.I., Lucknow Uty.	1,593.23	(+)14406.77(k)	(k) Less demand for funds received than anticipated during the year.
		40,000	1,900	608.	Control of bovine Pleuro-Pneumonia Assam.	1,835.48	64.52	

10,000	900	609. Eluciation of life history of— (i) Parafilaria bovicola, (ii) Satariacervi, and (iii) Setariadigtata including studies on their pathologicity and Theropensis, Bihar.	827.00	(+)73.00(a)
9,800	..	610. Investigation of Brucellosis, Bihar.	--	..
6,000	..	611. Experimental studies on Bovines Anaesthasia under Indian conditions, Orissa.	..	..
6,290	.	612. Disease investigation, Himachal Pradesh.	..	..
5,000	4,700	613. Lumber paralysis in sheep and goats, Punjab.	4,660.00	(+)40.00(a)
13,430	4,300	614. Lumber paralysis in goats, Orissa.	4,230.00	(+)70.00(a)
6,000	400	615. Investigation of mastitis, Bombay.	314.00	(+)86.00(a)
20,080	13,800	616. Investigation of mastitis, I.V.R.I.	13,866.50	(—)66.50(a)
7,000	5,600	617. Investigation of mastitis, Madras.	5,550.00	(+)50.00(a)
12,360	6,100	618. Investigation of mastitis, U.P.	5,990.00	(+)110.00(a)

1	2	3	4	5	6	7	8	9
			Rs.	Rs.		Rs. nP.	Rs. nP.	
					(*e*) *Dairying*			
			4,101	100	619. Pathogenic Bacteria, I.D.R.I.	87.00	(+)13.00(a)	(a) Inconsiderable.
			7,480	7,800	620. Preparation of Samtizers, I.D.R.I.	7,770.00	(+)30.00(a)	
			51,800	23,900	621. Bacteriological quality of Milk, Kaira, Bombay.	23,867.59	(+)32.41(a)	
			24,700	..	622. Accelerated oxidation test of Ghee, I.D.R.I.	..	..	
			320	2,900	623. Detection of adulteration and estimation of main constituents of milk, Punjab Uty.	2,900.00	..	
			1,10,000	..	624. Scope for the introduction of sterilized milk in India, W. Bengal.	..	..	
			25,000	..	625. Survey of Bacteriological quality of milk, Andhra.	..	..	
			26,000	1,100	626. Survey of Bacteriological quality of milk, Agricultural Institutes, Allahabad.	1,144.00	(—)44.00(a)	

15,000	..	627. Estimation of Milk Sucked by Calves in unweaned herds, Anand.	..	..
9,000	..	628. Application bacteriological test of milk, Calcutta. Milk Supply Scheme, W. Bengal.	..	..
83,780	..	629. Manufacture of concentrated milk of Co-operative Milk Producers Union, Anand.	..	..
27,410	..	630. Study of sterilization, cream and flavoured milk, Aarey Colony, Bombay.	..	..
12,000	..	631. Study of the let down response of breeds of Indian cows and buffaloes, W. Bengal.	..	..
28,000	..	632. Survey and Bacteriological quality of milk in Delhi, N.D.R.I.	..	..
..	200	633. Scheme for determining sediment test in Milk and Milk Products, N.D.R.I.	128.37	(+)71.73(a)
5,100	..	634. Standardising method for the analysis of Ghee, N.D.R.I.	..	..
5,000	..	635. Production of dehydrated powder and edible casein, I.D.R.I.	..	..

1	2	3	4	5	6	7	8	9
			Rs.	Rs.		Rs. nP.	Rs. nP.	
					(*f*) *Wool*			
			6,420	..	636. Wool analysis, Bihar.	..	..	
			..	700	637. Wool utilisation Centre at Coimbatore, Madras.	700.00	..	
					638. Sampling wool for measurement quality, Poona.	3,046.00	(—)3,046.00(g)	(g) Demand for funds received very late during the year.
					(*g*) *Skins and Hides*			
			22,000	10,100	639. Chemistry of minerals tannages, C.L.R.I.	10,084.00	16.00(a)	(a) Inconsiderable.
			6,000	6,600	640. Manufacture of fat liquors, C.L.R.I.	6,544.00	56.00(a)	
			9,160	..	641. Manufacture of Chrome retan leather, C.L.R.I.	..	..	
			6,509	6,500	642. Manufacture of leather boards, C.L.R.I.	6,414.00	86.00(a)	
			20,000	..	643. Skin studies of sheep (Co-ordinated scheme) Bombay.	..	..	
			2,000	..	644. Establishment of wool utilisation Centre, Madras.	..	..	

8,000	..	645. Influence of climate on performance of Desi strain of fowl, Madras.	..	..
4,000	..	646. Influence of climate on performance of Desi strain of fowl, Travancore Cochin.	..	..
10,610	..	647. Laying trials of Poultry, I.V.R.I.	..	..
15,120	12,100	648. Coccidiosis in Poultry, I.V.R.I.	12,070.00	(+)30.00(a)
12,000	17,400	649. Poultry Research, Travancore Cochin.	17,376.05	(+)23.95(a)
5,830	..	650. A. D. I. O. (Poultry), Andhra.	..	..
1,14,350	69,600	651. Poultry development American Mission, Madras.	69,533.23	(+)66.77(a)
15,000	17,000	652. Study of cross breeding in Poultry, Allahabad.	17,287.00	(+) 13.00(a)
8,000	..	653. Keeping Poultry in battery, in West Bengal.	..	..
80,970	..	654. Rearing of White Leghorn Chicken Y.M.C.A., Martandam.	..	..

1	2	3	4	5	6	7	8	9
			Rs.	Rs.	(*h*) *Poultry*—Contd.	Rs. nP	Rs. nP.	
			10,000	..	655. Economic Poultry, Andhra.	..	..	
			8,000	5,300	656. Economic Poultry, Madras.	5,230.00	(+)70.00(a)	(a) Inconsiderable.
			1,350	..	657. Economic Poultry, Punjab.	..	..	
			..	6,700	658. Defertilization of eggs, I.V.R.I.	6,700.00	..	
			14,930	1,700	659. Investigation of possibilities of correlation between physiological and body characteristics of eggs productions, I.V.R.I.	1,680.00	(+)20.00(a)	
			2,290	600	660. Cheap Poultry houses, Madras.	550.00	(+)50.00(a)	
			2,640	..	661. Cheap Poultry houses, Bihar.	..	..	
			2,150	900	662. Cheap Poultry houses, Orissa.	810.00	(+)90.00(a)	
			2,790	700	663. Cheap Poultry houses, U.P.	700.00	..	

27,230	..	664. Investigating the advantages of biology production large Unit, Hyderabad.	..	..
14,800	..	665. Economic Poultry Ration, Mysore.	..	..
19,070	3,900	666. Duck Breeding, Kerala.	4,201.70	(−)301.70(a)
12,400	8,800	667. Duck Breeding, I.V.R.I.	8,770.00	(+)30.00(a)
		(*i*) *Fish*		
4,540	..	668. Processing of unpopular Fish, West Bengal.	..	..
6,000	..	669. Study of Microfial flora-fresh water fish from Bay of Bengal, West Bengal.	..	..
..	2,800	670. Improvement of Craft and tackle in fishing, Orissa.	2,797.00	(+)3.00(a)
14,000	27,500	671. Hydro-trological and Fanistic Survey of the Godavari Estuarine System, Andhra Uty.	27,450.00	(+)50.00(a)
12,000	..	672. Ecology of fresh water fish in U.P., Lucknow Uty.	..	..
18,000	..	673. Research in Paddy-*cum* pisciculture in Krishna District—Andhra.	..	..

1	2	3	4	5	6	7	8	9
			Rs.	Rs.		Rs. nP.	Rs. nP.	
					(*j*) *Agriculture*			
			5,720	4,800	674. Establishment of Bee keeping centre, Madras.	4,800.00	..	
			3,850	—	Northern Region Chamba (H.P.).	..	..	
					(*k*) *Miscellaneous*			
			..	18,700	675. Award of fellowships in A. H. Subject, I.V.R.I.	18,024.16	(+)675.84(a)	(a) Inconsiderable.
			7,200	..	676. Diploma course in Swine Husbandry and pork processing at Central Dairy Farm, Aligarh, U.P.	..	..	
			..	100	677. Using Cow for work, I.D.R.I.	3.00	(+)97.00(a)	
			2,930	1,500	678. Using Cow for work, I.V.R.I.	1,415.46	(+)84.54(a)	
			2,900	..	679. Post graduate course in parasitology, Madras.	..	..	
			..	900	680. Award of Fellowship in A. H. Subjects, Bombay.	845.00	(+)50.00(a)	

..	2,100	681.	Award of Fellowship in A. H. Subjects, Calcutta.	2,050.00	(+)50.00(a)

III. Combined Agriculture & Animal Husbandry.

(a) Development

7,200	..	682.	Production and trial of agriculture Implements—I.A.R.I.	..	..
..	800	683.	Research fellowship in Agriculture, Institute of Agriculture, Anand.	750.00	(+)50.00(a)
300	600	684.	Research fellowship in Agriculture, Institute of Agriculture, College of Agriculture Poona (B.S.).	546.00	(+)54.00(a)
..	600	685.	Reserach fellowship in Agriculture, Institute of Agriculture, Agriculture College, Baptala (Andhra).	600.00	..
1,600	1,200	686.	Research fellowship in Agriculture, Institute of Agriculture, Maharaja College, Ernakulam (Kerala).	1,200.00	..
1,600	2,400	687.	Research fellowship in Agriculture, Institute of Agriculture, Govt. Agricultural College, Ludhiana.	2,330.00	(+)70.00(a)

1	2	3	4	5	6	7	8	9
			Rs.	Rs.		Rs. nP.	Rs. nP.	
					(*a*) *Development*—Contd.			
			2,200	..	688. Research fellowship in Agriculture, Institute of Agriculture, P. U. College, Hoshiarpur.	..	..	
			1,600	1,600	689. Research fellowship in Agriculture, Institute of Agriculture, Institute of Technology, Kharagpur, W. Bengal.	1,600.00	..	
			2,200	2,800	690. Research fellowship in Agriculture, Institute of Agriculture, I.V.R.I.	2,740.00	(+)60.00(a)	(a) Inconsiderable.
			2,200	..	691. Research fellowship in Agriculture, Institute of Agriculture, Travancore Hindu College, Nagareoil (Madras).	..	..	
			1,600	..	692. Research fellowship in Agriculture, Institute of Agriculture, Sugarcane Breeding Institute & College, Coimbatore.	..	..	

6,750	1,600	693.	Research fellowship in Agriculture, Institute of Agriculture, I.A.R.I.	1,550.00	(+)30.00(a)
1,070	5,200	694.	Survey of indigenous Implements, I.A.R.I.	5,200.00	..
..	8,600	695.	Survey of indigenous Implements, PEPSU.	8,565.00	(+)35.00(a)
7,070	..	696.	Research fellowships in Agriculture Govt. Agricultural College, (Kanpur), U.P.	..	..
4,490	5,100	697.	Research fellowships in Agriculture, Govt. Agricultural College, B. R. College, Agra (U.P.)	5,020.00	(+)80.00(a)
50,000	28,600	698.	Research fellowships in Agriculture, Govt. Agricultural College, Other States.	28,577.20	(+)22.80(a)
1,64,910	..	699.	Survey of Additional Indigenous Agricultural Implements, All States, Jammu and Kashmir.	..	..
..	12,000	700.	Survey of Additional Indigenous Agricultural Implements, I.A.R.I.	12,000.00	..

1	2	3	4	5	6	7	8	9
			Rs.	Rs.		Rs. nP.	Rs. nP.	
			IV. Statistical and Miscellaneous Schemes					
			3,500	14,500	701. Scheme for studying the intensive cultural practice in small holding, Calcutta Uty.	14,500.00	..	
			18,000	5,700	702. Pilot sample investigation practices and yield on Orange Crop, M.P.	5,620.00	(+)80.00(a) (a)	Inconsiderable.
			34,770	..	703. Pilot sample investigation on the cultivation practices and yield in Mango Crops, U.P.	..	..	
			..	9,200	704. Pilot Survey inland fisheries, Hyderabad.	9,102.00	(+)98.00(a)	
			..	100	705. Livestock and fishery statistics, Bombay.	63.64	(+)36.36(a)	
			..	400	706. Improvement of Livestock Statistics.	334.044	(+)65.56(a)	
			9,000	..	707. Study of mechanised farming, Benaras Hindu Uty.	..	..	

4,650	..	708.	Study of Economics of Breeding, Bombay.	..	..	
28,630	..	709.	Scheme for further investigation on the technique of sampling of fleeces for weaving wool quality, Bombay.	..	..	
1,000	4,800	710.	Study of farm and non-farm employment in South Arcot District, Anamalai Uty.	4,770.00	(+)30.00(a)	
..	35,280	711.	Sugarcane Production, Other Centres.	(—)11,841.41	(b)	(b) Amount of Rs. 47,121 refunded to the G. I. has been shown under separate head.
6,280	7,300	712.	Pilot Sample Survey Pepper, Kerala.	7,260.00	(+)40.00(a)	
23,800	..	713.	Schemes for study of Economic conditions of Ghata Prabha Left Bank Canal Area, Mysore.	..	..	
7,730	..	714.	Study of Production & Consumption Aspect of Agri. families in different class structure at Anand (Bombay).	..	..	

1	2	3	4	5	6	7	8	9
			Rs.	Rs.		Rs. nP	Rs. nP.	
					D. Contribution to Institutions			
			37,300	37,300	715. Commonwealth Agricultural Bureaux, Imperial Institute of Mycology, Imperial Institute of Entomology, Farnham House Laboratory, Imperial Bureaux of Dairy Science, Fruit Preservation Research Station, Campden.	37,250.00	(+)50.00(a)	(a) Inconsiderable.
					E. Debits and Remittances			
			15,000	12,900	716. Loans and Advances .	13,651.49	(—)751.59 (a)	
			0,000	1,10,000	717. Deposits & Advances repayable.	2,30,542.02	(—)1,20,542.02	(k) Adjustment bills not received during the year.
			35,000	61,300	718. Payment of income tax, provident fund etc.	45,419.78	(+)15,910.22	(m) Certain arrears received during the next financial year (1959-60).
					AMOUNTS REFUNDED TO GOVERNMENT OF INDIA			
					719. Co-ordinated Wheat Rust Control.	32,917.00		
					720 Weed Control .	26,104.00		

721. Japanese Method of Paddy Cultivation.		70,611.40
722. Livestock & Fisheries Statistics.		93,419.00
723. Using aerial Photography for Crop estimation.		2,997.08
724. Pilot Sample Survey on Pepper.		25,000.00
725. Rinderpest Eradication Scheme.		42,073.17
726. Bee Keeping Industry		9,540.00
727. Sugarcane Production		47,121.00
Total Expenditure .		68,30,328.26
Investment and Re-investment.		32,00,000.00
Closing Balances—		
Cash in Hand on 31-3-59 .	802.98	..
Cash with State Bank of India (General).	29,85,296.09	..
Cash with State Bank of India (Provident Fund).	97,540.16	30,83,639.23
GRAND TOTAL . .		131,13,967.49

GIPN—S7—4 I.C.A.R./60—3-5-61—1,340.

hhhhhhhhuuuuu

ERRATA TO THE I.C.A.R. ANNUAL REPORT FOR 1958-59.

Read 'Kheti' for 'Khet' on page vi under the Chapter Agriculture Information.

Read	AGRICULTURE	for	AGRICULTUR	on	page	155,	sub-head.			
"	wheat	for	whea	on	page	155	against	item	No.	32.
"	12,42,400	for	12,12,400	on	page	157	against	item	No. 50	under col No.4
"	7,600	"	7,500	"	159	"	"	67	"	5
"	44,000	"	44,800	"	161	"	"	79	"	5
"	3,218.16	"	218.16	"	167	"	"	138	"	7
"	105.18	"	115.18	"	167	"	"	143	"	8
"	-5,571.00	"	-	"	169	"	"	162	"	7
"	+29.00(a)	"	-	"	169	"	"	162	"	8
"	6,260	"	2,260	"	213	"	"	581	"	7
"	17,300	"	17,000	"	221	"	"	652	"	5
"	6,230	"	6,280	"	229	"	"	712	"	4
"	32,971	"	32,917	"	230	"	"	719	"	7
"	50,000	"	0,000	"	230	"	"	716	"	4

"BRK"
11.7.61.